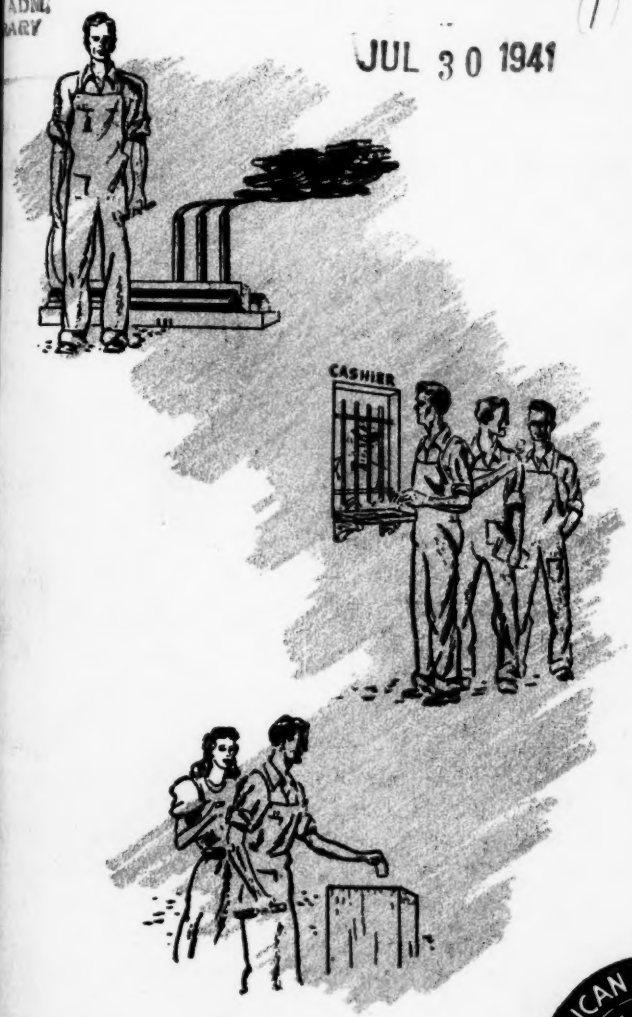
Personnel

ADM.
LIBRARY

JUL 30 1941



In This Issue

Reducing Accidents In Defense Plants

★

Selecting and Training Inspectors

★

Apprentice Supervision

★

Selling a Rating Plan

★

Industrial Relations And National Defense

AMERICAN MANAGEMENT ASSOCIATION
AMA

JULY, 1941

THE AMERICAN MANAGEMENT ASSOCIATION

The American Management Association is composed of industrial and commercial companies and executives interested in modern management. The AMA makes no profit, does no lobbying, and advances no propaganda. Its interests are solely the solution of current business problems.

Organization and Operation

The AMA serves its members through seven divisions: Office Management, Personnel, Production, Marketing, Finance, Insurance, and Packaging. Each of these divisions is headed and directed by a man drafted from industry.

Conferences

Each of the seven AMA divisions holds at least one annual conference, where problems of timely importance in its field are discussed. Printed conference proceedings go to members of the divisions concerned.

Information and Research

The AMA Information and Research Department places at the command of every member company a trained research staff on management problems. In addition, the AMA maintains a modern, up-to-date library of management books and business publications.

AMA Periodicals

THE MANAGEMENT REVIEW (monthly) contains digests of articles on management appearing in over 400 publications, and brief reviews of current business books. It enables a busy man to survey all current topics of interest to him in less than 30 minutes. PERSONNEL (bi-monthly) publishes articles on employee selection, training, compensation, and the like. BUSINESS CONDITIONS AND FORECASTS (monthly) gives a summarized analysis of the statements of six of the foremost business services.

The object of the publications of the American Management Association is to place before the members ideas which it is hoped may prove interesting and informative, but the Association does not stand sponsor for views expressed by authors in articles issued in or as its publications.

No portion of the contents of this publication may be reprinted without express permission of the American Management Association.

Personnel

CONTENTS JULY, 1941

VOL. 18 No. 1

REDUCING PLANT ACCIDENTS UNDER HIGH-SPEED DEFENSE PRODUCTION *By W. H. Cameron* . . . Page 2

THE SELECTION AND TRAINING OF INSPECTORS . . . Page 14
By Joseph Tiffin and H. B. Rogers

SUPERVISION OF APPRENTICES . . . Page 32
By O. L. Harvey

SELLING A RATING PLAN . . . Page 42
By Edward N. Hay

INDUSTRIAL RELATIONS AND NATIONAL DEFENSE: A CHALLENGE TO MANAGEMENT . . . . . Page 49
By Douglas McGregor and Irving Knickerbocker

Editor—JAMES O. RICE, 330 West 42nd Street, New York, New York
Assistant Editor—M. J. DOOHER

PERSONNEL is published bimonthly by the American Management Association at 330 West 42nd Street, New York, N. Y., at fifty cents per copy or three dollars per year. Vol. 18, No. 1, July, 1941. Entered as second-class matter August 8, 1938, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

REDUCING PLANT ACCIDENTS UNDER HIGH-SPEED DEFENSE PRODUCTION

By W. H. CAMERON
Managing Director, National Safety Council

Accidents are on the increase! The stepping-up of the industrial tempo caused by defense operations has resulted in a definite increase in work accidents. In this article the Director of the National Safety Council considers the safety problem that the defense production program presents and suggests definite steps that can be taken by plant personnel directors in meeting this threat. He considers such points as: safety and the new employee, the "accident-prone" employee, physical defects, etc.

THE frequency of accidents in industry is increasing. Accidents are killing many employees, injuring more employees than they kill, damaging material and equipment, upsetting production and adding penalties to the cost of production that cannot be afforded.

This is a simple, though distressing fact. It's no myth.

Fanning out from the impact of this fact come expressions of concern and requests for ways and means of arresting and reversing the trend.

There is evidence in the appeals that come to the National Safety Council that the increasing frequency and cost of accidents have thrown some front offices into a dither that is admission of at least partial helplessness. Between the lines of many inquiries are implications of confusion growing out of conditions such as these:

"We're guarding all our machinery, as always. Every employee has a book of safety rules. Our foremen do their best to follow through with supervision for safety. We supply our men with safety goggles, safety shoes, etc., wherever the job calls for them. Safety meetings are held regularly. We do our best to keep a good housekeeping program going. Plant illumination and ventilation seem adequate.

"We have been adding new employees. We recognize that new employees need special consideration and supervision until they adjust themselves to the new surroundings and new work processes, but they are suffering an unnecessarily large number of accidents."

Admittedly, the accident record for the past year or more, viewed superficially, does pose something of a dilemma.

Can this bugaboo problem of rising accident totals be whipped? Yes. Can it be whipped in the face of the rush of defense work? Yes. Can personnel men contribute vital help? Yes, although perhaps not in the line of regular personnel work.

First, let's face the fact of rising accident frequency and refuse to become emotional about it.

Second, let's admit and agree that we can get and hold the whip hand.

Now, from a safety man's point of view, let's look at a few of the facts and see if they don't suggest a solution.

THE 1940 RECORD

A brief review of the 1940 record seems desirable. Work accidents in 1940 killed 17,000, a 10 per cent increase over the 15,500 death total for 1939. Injuries resulting in permanent or temporary disability numbered approximately 1,400,000. Wage losses, medical expense and the overhead cost of insurance total about $650,000,000.

The industrial commissions in 30 states received reports of 8 per cent more occupational deaths in 1940 than in 1939. In 20 of the states accident death totals increased. Only eight states showed decreases and two had no change.

To compare with this 10 per cent increase in work accident deaths, total employment increased less than 3 per cent and employment in manufacturing industries increased 6 per cent. Accident fatality rates were, therefore, definitely higher.

THE NEW MAN

The increased employment is a clue to part of the reason for increased accident frequency rates. But a complete solution does not lie in correcting the erring ways of new employees.

Various special studies have indicated that the accident rates of new employees during the first year of employment are at least twice the rates for older employees. This is a conservative statement. In examining the material available, we find that none of the special studies contains a statement of the method followed in tabulating the information—there are a number of extremely significant errors, which might result from various methods of tabulation, into which the statistically uninitiated might fall.

For example, there is nothing in any of the special studies to indicate that accidents occurring throughout the year were not classified according to the experience of the employee *at the time of the accident* and then compared with the experience of the employees on the payroll *at* the end of the year and *as of* the end of the year. Such an error could result in overstatement of the new employee rate amounting to more than 2 to 1.

Another point: a new employee could injure an old, or veteran employee. Such an accident would be classified as an "old employee" accident, and would bring frequency rates for the two groups closer together.

Furthermore, at no place in the various studies do we find consideration given to the fact that a new employee may be a very experienced, skilled laborer. It might be true that such a new employee would have a slightly higher accident rate due to unfamiliarity with the new job, but it seems quite unreasonable to suppose that this extra hazard would approach at all the additional hazard of young, new employees without previous experience in industry. Yet both types, for purposes of accident record keeping, are classified as new employees.

The National Safety Council has no detailed information on the types of accidents suffered by new employees to compare with the types suffered by veteran employees. However, in the course of our analyses of accidents occurring in the paper industry, it was found that accidents involving nip points showed clearly that the principal personal cause among older employees (in point of service) was disobedience of instructions. For new men, with less than one year of experience, lack of knowledge of safe practices and lack of skill were most frequently assigned. These results are only what would be expected.

Inasmuch as the so-called new employee (who actually may be new or experienced by reason of previous employment in the same type of work) currently is the principal concern in the problem of increasing accident rates, let's determine exactly what we mean when we say, "new employee." Is he actually brand new, or has he had previous experience? In the accidents that are occurring in your plant, is the new man the cause, the victim, or the cause and the victim? This determination should be easy. Do accidents involving these men indicate a lack of discipline, of counsel and training, or something else?

If a particular case seems to call for discipline, has the fault been wholly with the employee, or has his foreman tacitly encouraged both new and veteran employees to cut corners by winking at violations of safety rules?

If a particular case seems to call for counsel and training, is the foreman really capable of giving intelligent counsel or training to an inexperienced employee? Has management actually given the foreman the extra time from production duties that it takes really to train a new employee? Is the foreman of the hardboiled type that would be apt to keep a new man on edge during his first few weeks or months on the job? Had the employee been pressing in an effort to match production of older heads right from the start, because of his eagerness to give satisfaction?

I ask all these questions because, obviously, they touch subjects that are vital factors in the cause of accidents and reduced production efficiency in general. Intelligent training and thoroughly competent, sympathetic supervision are extremely important. Training should be far more intelli-

gently comprehensive than the distribution of safety rule books to new employees. Supervision should be far more competent and sympathetic than punitive discipline after violations have occurred. Even the outline of a wise employee-training program and the techniques of judicious supervisory procedure could not be set forth here. Personnel, production and safety men know what training and supervision should include and the specific, local problems in each organization.

However, let me say simply that flaws and failures in training and supervision often are construed as something else and serve only to confuse. Frequently an unfair case is made against the employee—that he is a misfit, accident-prone or possessed of poor attitude, when actually such diagnosis is wrong and the real trouble is something no more mysterious than a foreman who hasn't "done right" by the new employee.

In other cases, where there is certainty that the training and supervision of the new man is not at fault, such things as cataracts on the eyes in the early stages of development, bad teeth, slight deafness, etc., might be the cause—not habitual carelessness. Usually, neither the employee nor his foreman are aware of what's wrong and both are apt to feel the employee has some queer streak of carelessness in him that he can't or won't control.

A careful study of the type of accidents involving these new men, a check of their previous employment records, and an examination of the type of foreman-supervision to which they have been exposed will tell us much about the "new man" problem. At least it will start a methodical winnowing and sifting process which will indicate how much of the responsibility can be laid directly at the door of the personnel office and how much should have been the responsibility of the medical department, or of the foreman and others because of inept training and guidance.

PHYSICAL DEFECTS

How about some of these physical defects that might, under not unusual circumstances, earn a man unfair classification as a careless worker or accident-prone?

I recognize that the attitude of some labor leaders is a distinct obstacle to setting up a policy of compulsory, pre-employment physical examination, particularly in locations where state law does not require it.

However, there are physical defects which are not revealed in the average, cursory physical examination and which are direct causes of accidents. Let's consider such an example:

A company wanted an operator for an overhead traveling crane. The applicant seemed to measure up on all counts. His physical examination showed his heart to be all right, that there was no tuberculosis or ill effects

from other illness. His muscular coordination was good. He was mentally alert, cautious and conscientious. He knew cranes and seemed to have a good sense of speed and direction. He was neither near-sighted nor far-sighted. He got the job.

Almost immediately he began to cause accidents, mostly property damage accidents which resulted from dropping crane loads too heavily to the floor, into trucks or on the platforms.

Re-examination by the personnel and safety departments disclosed no rational explanation for his accidents. The decision was that he was "just plain careless, didn't watch what he was doing and couldn't be trusted with the responsibility of the crane job." There was no other job in the plant at the time and he was dismissed.

A few weeks later the personnel man was discussing the case with a doctor friend, an eye specialist, and it impressed the latter as such an unusual case that he asked for the man's name and address, got in touch with him and had him come in for an examination.

The specialist found an error in the accuracy of the man's depth perception. Although he could see clearly, things looked farther from him than they actually were. The deficiency offered a complete explanation of the man's crane accidents. In lowering loads, the truck or floor or platform appeared to be still six or eight feet below the load when, actually, the distance was only three or four feet. Consequently, the load was banged down before the operator began to decelerate the rate at which he was lowering it.

Error in accuracy of depth perception is not common, nor is it rare. And it wouldn't cause accident trouble except on jobs where the employee had to judge distance—as in driving an automobile or plant power truck, operating the boom or bucket of a power shovel, etc.

Among other accidents which have come to the attention of the National Safety Council are these:

1. An employee had caused quite a few accidents in a six months period. The employee couldn't understand it himself and was very depressed about prospects of losing his job. The foreman hated to discipline the man severely because of his previous good record, but the man "obviously" had grown careless. Finally, upon the foreman's recommendation that the man be discharged or switched to another department, the safety director asked to see the employee. He sent him for a complete, thorough physical examination and the first signs of developing cataracts were discovered in both eyes. The man was treated and eventually became again the safe worker he had been previously.

2. In another similar case the employee was found to be developing diabetes and suffering the fatigue that comes with that sort of affliction.

He was treated and transferred to another job where he was off his feet at least half the time. He was no longer a problem as a careless worker.

If the truth were known, hundreds of employees probably become known to their foremen as careless workers, when the real trouble is some physical or mental defect that will respond promptly to the right treatment.

Here are a few other physical conditions which are not checked in the average physical examination, and which frequently involve employees in an accident.

1. Incipient and venereal diseases. Long before the disease produces obvious symptoms—even before the man realizes that something serious is wrong with him—syphilis and gonorrhea would cause him to become fatigued easily, to suffer brief periods of mental confusion or nerves that would ripen him for an accident he otherwise would avoid.

2. Incipient tuberculosis, silicosis, epilepsy, foci-infection (bad teeth, tonsils, liver, lungs or bladder, etc.) very well might be the complete explanation of why a man becomes an accident repeater—because of worry, fatigue, and strange pains or aches.

3. There are many other things about a man's physical condition which render him vulnerable to accident hazards that are not caught by a cursory medical examination, and which still are not so severe as to cripple him or confine him to his bed—such as hyperthyroid condition, anemia, dangerously high or low blood pressure, or a serious deficiency in a particular vitamin in the man's diet which has sharply reduced his vitality; in short, anything that might cause the man to become easily fatigued.

THE ACCIDENT CAUSE CODE

For still other causes of accidents that are not discernible in routine examination of the applicant, let's look at a section of the Accident Cause Code (sponsored by the National Safety Council, the National Council of Compensation Insurance and the International Association of Industrial Accident Boards and Commissions).

Under "Personal Causes of Accidents" the cause code lists:

1. Improper attitude.
   a. Disregard of instructions.
   b. Recklessness.
   c. Abstraction.
   d. Haste.
2. Lack of knowledge or skill.
   a. Unaware of safe practice.
   b. Unpracticed or unskilled.

3. Bodily defects.
   a. Weakness—muscular.

How many of the above can be detected by pre-employment aptitude tests? Personnel executives know the answer. I don't. But many of the causes listed above seem to be the type of trouble that would have been avoided or could be corrected by intelligent, thorough foreman-supervision and constant education and training under the program of the safety department.

A number of these personal traits that lead to accidents won't become apparent until after the man has been on the job a while, exposed to the variables of day-to-day association with personalities and developments in the shop.

I believe personnel executives will agree that more than a few of these personal causes result from deficiencies in training and teaching, and not from accident proneness or the fact that the man has been on the payroll for only a few days or weeks.

ACCIDENT-PRONE EMPLOYEES

I don't like the description "accident-prone employee." Controversy about the existence or non-existence of accident-prone workers arises entirely out of the definition of the term.

Some personnel and safety executives would say: "This man shows marked symptoms of developing hernia; therefore, he is prone to accidents on a job that requires him to lift anything heavier than a pencil or a glass of water."

The same person would say of another man: "This man is muscle-bound and his hands are all thumbs; therefore, he is prone to accidents on a delicate precision job."

Take a dozen or a hundred such individual cases, lump them, generalize about them, and the average personnel or safety man is likely to refer to them as accident-prone workers.

Nonsense! Why introduce that middle-man term? One of the men merely has symptoms of developing hernia; another is muscle-bound and all thumbs; another is color blind; another needs re-training; another should be transferred to day-rate work from the pressure of piece work, and so on.

How many times have you heard: "If only we could find some pre-employment test that would weed out the accident-prone applicants, our accident problem would be whipped?" That certainly is admission of a feeling or belief that there is a fraternity of men and women with some mysterious trait in common that propels them into accidents, no matter what job they

work at or no matter how much good training and supervision they are given.

"Accident-prone" is nothing more than a convenient catch-all classification for those of us who can't or don't want to bother to play the string out in analyzing a man's physical and mental habits and background to determine why he repeatedly has become involved in accidents.

So far as any pre-employment test is concerned that will reveal for our rejection this curious creature, the accident-prone employee, we'd better forget the possibility of such a thing. The closest comparable thing that has come to my attention is an admittedly very rough rule of thumb that only hints at a possibility that if a person learning to drive an automobile shows some adeptness at parking a car at the curb, he has a better than average chance of becoming a good and safe driver. But mere mention of this rule of thumb credits it with more accuracy than has anywhere been claimed for it. Furthermore, in applying it, the applicant always is being tested for exactly the same job—driving an automobile.

If some organization were to run hundreds of exhaustive tests and checks on lathe operators, hundreds more on punch press operators, hundreds more on loaders and pilers, and so on, until every industrial operation were covered . . . and then wait until a number in each group had caused or been injured by an accident . . . and then check the results of the original tests on the accident workers against those of employees in each group who didn't have accidents, then, we *might* have a rule of thumb to guide us in the future. But I doubt that any of us would place much faith in such a rule of thumb.

I submit that we will be much closer to a solution of both the so-called accident-prone worker problem and the problem of high accident frequency among new employees by adding a few more items to the check list from which the applicant for a job is examined.

First, I understand that it is possible to measure scientifically about a dozen or thirteen distinct physical and psychological aptitudes in the new worker and thus assist placing him in the work for which he is best fitted. Personnel people are far more familiar with such tests and how to interpret them than I am.

If all these aptitude tests are given competently and interpreted accurately, I have faith that they are of valuable aid in determining areas of ability, which is a big stride toward insuring the efficiency and safety of the work force with which a personnel department staffs a plant.

But it is a personnel man's bromide that we always know all the faults of the men already at work and only the good points of the applicant being interviewed and tested. The applicant always puts up his best front, prob-

ably is freshly shaved and neat appearing, and has summoned all his common sense and intelligence for a concentrated effort to get the job.

After aptitude tests and physical examinations have eliminated or checked as many as possible of the things about a man, the only way we can tell whether he will have accidents as a lathe operator is to put him on a lathe for a few weeks.

It isn't until after he is on the job that such things as fatigue, monotony, day dreaming, nerves, new surroundings, relationship with the new foreman, and the personalities of his co-workers begin to rub his sensitivities, either favorably or unfavorably. The control of factors such as these is every bit as important, so far as safety is concerned, as determining a man's area of aptitude. Obviously, if a man is working at a job for which he seems to be mentally and physically suited, he is less apt to feel his job is monotonous, or to day dream, succumb to nervous jitters, etc. But even the best of us suffer mental or physical distress now and then or are provoked to fits of temper, spells of momentary day dreaming, or periods of distracting irritation, as personalities clash.

A JOB FOR SUPERVISION

It is on the job that supervision, training and education go into action as a guard against accidents and the quality of none of these three things can be checked ahead of time so far as a particular case is concerned.

Fatigue, day dreaming, distraction, nervousness, lack of confidence, monotony, and such, are very real causes for very many accidents—and I doubt that any physical or psychological tests for aptitudes, no matter how scientific, would indicate whether a man is inclined to day dream, worry, become distracted or nervous, etc., under certain or special circumstances that develop from day to day. New employees, of course, are more apt to fall victim to these things than older employees who have passed their orientation and become adjusted to their new surroundings.

The new man may know his job pretty well, but be unfamiliar with or fail to respect accident hazards. Training and supervision must impress upon the new worker, constantly and repeatedly, that he must work safely —that he is no good to himself or the company if he is hurt or hospitalized for several weeks. The new man also must be convinced that he will not be judged against veteran employees so far as his production is concerned, until he has had ample time to become adjusted and, hence, that he needn't feel concerned if he can't match the production of old timers right from the start.

In discussing accidents, allegedly due to accident proneness, personnel people should make absolutely certain that an unfair case is not made

against a worker and that the real reason isn't neglect by management to provide adequate mechanical and personal protection equipment, or, neglect to provide adequate training and competent supervision. There should be double emphasis upon adequate training and competent supervision in the case of new employees, and it should extend not only over the first few weeks of employment, but throughout several months—even longer if a particular employee seems to have a blind spot or two in his knowledge of the safety rules and procedures his job involves.

I feel certain that the accident-prone employee problem that so many personnel and safety people profess to worry about will disappear practically to non-existence if the first concern is about really thorough physical examinations and really competent, patient supervision and training.

DEFENSE SPEED-UP

Unquestionably there has been a speed-up of general industrial work resulting from production under the defense program, and it has had and can have repercussions in terms of more accidents.

Actually, however, there has been little or no speed-up on individual jobs, such as turning up the speed of single machines to increase output, or of decreasing rates on piece work, thus forcing the operator to work faster than the speed to which he has been accustomed.

The increase has come, principally, from running two shifts instead of one, three instead of two, and of working employees overtime more frequently and for longer periods.

The threat of accidents comes in finding competent, safety-trained supervisors to handle the expanded personnel; in repair and maintenance work necessary to keep tools and machinery in tip-top safe shape, and in keeping employee-training and on-the-job supervision abreast of the increased safety problem.

When running longer hours there also is the problem of finding storage space for finished products until such time as they can be shipped, or of increasing the speed with which finished products are cleared from the shop. At the other end of the production line there is the problem of storage space for raw materials—stock piles and so on. This will create a general housekeeping problem if the plant is to be maintained in orderly fashion. "A place for everything and everything in its place" is a cardinal safety rule. If the plant is cluttered up with crowded aisleways, floors loaded beyond their safe capacity, and scattered odds and ends of scrap and material here and there, each such condition is a definite weak spot in your protection against accidents.

However, the problems of maintenance, repair, housekeeping, creating

more worker-fatigue through overtime, etc., are local problems, to be solved accordingly. It is my purpose here only to call attention to them as problems in safety programs under defense production schedules.

SUMMARY

I wish I could conclude with a few simple rules that would guarantee perfect protection against accidents as a result of the special problems arising from defense production—the problems of the new employee, of maintenance, housekeeping, speed-up, and of the so-called careless or accident-prone worker.

In connection with the new man problem, it is my hunch that most of them do not get a thorough enough pre-employment physical examination and that most of them do not get sufficient training, education and supervision of the right sort. The objection to this implied suggestion is, of course, "We haven't time these days for training programs as complete as we'd like to have them—we can't find enough foremen to staff the plant on a two- and three-shift basis." I realize that this objection is only too true, but I have no other constructive suggestion to make. Wishful thinking about a simpler alternative seems futile.

With the new man: apply aptitude tests, give a good physical examination, perhaps using the "personal factors" section of the Accident Cause Code as a guide, and then see to it that he gets the best training and supervision you possibly can give him.

With the "accident-prone" worker: the suggestion here is practically the same as for the new man. Give him all the personnel tests that seem pertinent. Give him a thorough physical examination (but, instead of using the Cause Code for a guide, use the pattern of the several accidents he has caused. Do they indicate faulty vision, muscular in-coordination, fatigue from some developing disease or affliction?). Study his foreman and co-workers. Is there an irritating personality involved in the case? How about family and other off-the-job worries?

Defense speed-up: the problem here seems to be maintaining an orderly plant, safety-wise and production-wise, providing for continuous and effective maintenance, repair and guarding of tools and machinery, and finding enough trustworthy foremen and other supervisors to go around. Easily said and not so easily done these days, I know, but very important if accidents are to be avoided.

Fatigue: the shortage of employable men and women, which makes overtime necessary, thus causing more worker-fatigue and physical exhaustion, seems like a conspiracy against a good safety record. But here, again, alternatives seem to be missing. Brief rest periods, distribution of energy-

giving food, and piping music to all departments, have been used here and there as antidotes for ordinary fatigue. However, each creates many special problems itself and is not arbitrarily recommended for any or all plants.

A PROGRAM

1. Use aptitude tests as completely and intelligently as you can.

2. Provide for really thorough physical examinations, with special attention to possible physical defects that might cause the man to have accidents on the particular job for which he is to be hired.

3. Set up and encourage a patient, thorough, intelligent program of employee training, matched by equally intelligent and patient supervision.

4. If a man becomes involved in several accidents, study the pattern of those accidents for a clue. Check possible off-the-job worries, and physical defects that may have developed since employment. Recheck his foreman and the morale and personalities in his department.

5. When no other explanation can be found, check for things that may be causing employee fatigue, worry or distraction. One of these three often is at the roots of an accident.

6. Be certain, continuously, that machines, tools, materials, lighting, ventilation, housekeeping and work processes are effectively guarded, safe, sufficient, adequate, and so forth.

With allowances for special conditions peculiar to particular plants, faithful and competent application of the procedures suggested in these six points can almost be guaranteed to correct or minimize accident problems created by new employees, accident-repeaters and the increased pace of production.

THE SELECTION AND TRAINING OF INSPECTORS

By JOSEPH TIFFIN
Professor of Industrial Psychology
and
H. B. ROGERS
Associate Professor of Industrial Engineering
Purdue University

With unit output increasing at an almost unprecedented rate, plant management is being seriously confronted with the problem of maintaining quality. Inspection departments must now operate on the highest possible efficiency level. In this article the authors describe the method of selecting and training inspectors in a tin plate mill. While the conclusions reached may not apply to the inspection of other products, the method employed illustrates principles that could be used in nearly all kinds of inspection work.

THOUGH nearly every phase of industry is being affected in one way or another by the defense program, the processes of inspection have assumed a position of particular importance in this broad expansion of production. Defective material which passes inspection in a peace-time economy is likely, at the worst, to result in customer inconvenience, complaints, or material returned for replacement. But in war-time economy, defective material may result directly in loss of life. Gas masks, machine guns, airplane parts, fire control instruments, and many other products of the present program of defense production must be inspected with an accuracy which has been both unknown and unnecessary in peace-time production.

This article describes certain procedures which have been found helpful in the selection and training of tin plate inspectors. It is recognized that the specific conclusions reached with regard to this one type of inspection may not apply directly to inspection of other products. But the methods described, which have been found to result in definite improvement both in the selection and training of these inspectors, will apply with very little modification to the problems of selecting and training employees for any inspection job. It should be emphasized that this is an article on *methods*. Application of these methods to tin plate inspection has been chosen as a means of describing these methods because two years of first-hand experience in their application on this job have given direct evidence of their practicality.

The job of tin plate inspecting, ordinarily called assorting, is essentially an inspection for appearance which is made while the inspector turns

the sheets of tin plate from one stack to another. As the sheet is turned, the inspector makes a decision from the appearance and feel of the sheet as to whether it is a prime or second, or contains one of a number of possible defects. The standard size sheet is approximately 28 by 30 inches, though this varies with the specific order. In the plant studied, the work is done by women assorters.

Supervision has generally felt that inspectors on this job do not reach their maximum performance until they have had approximately six months of experience. The girls are paid on a straight and uniform hourly rate. At the time of these experiments approximately 300 girls were employed in this operation.

HOW ACCURATE ARE THE INSPECTORS?

In any experiments intended to result in a battery of tests for selecting capable operators, it is necessary, first of all, to obtain what is called a "criterion." A criterion is simply a measure of the operator's actual ability on the job. When operators are paid on a piece-rate basis a satisfactory criterion can usually be obtained from the records of quantity or quality of production, or in some cases a combination of both. In the case of the present inspectors, however, who were paid on an hourly basis, no such criterion of job performance was available. It was therefore necessary, at the outset, to design a method of measuring how well each of the present employees could do this job of inspection, and how great the differences were from one inspector to another in the accuracy of work. After considerable preliminary experimentation, a coded stack of tin plate containing 150 sheets was assembled. This stack was assorted (inspected) by 150 operators. This coded stack was made up of 61 prime sheets (sheets satisfactory in every respect) and second sheets (sheets containing a minor surface blemish or uneven coating of tin), 30 sheets containing appearance defect No. 1, 26 sheets containing appearance defect No. 2, 13 sheets containing appearance defect No. 3, and 20 sheets containing a weight defect. The prime and second sheets were included in a single category for the purpose of the experiment because with repeated assortings the prime sheets tend to become scratched and thus to become seconds. The other defective plates included in the coded stack remained the same regardless of the number of times the stack was assorted.

The defects are referred to in the present article by number rather than by name because it is the method of measuring the accuracy of the inspectors rather than their accuracy on specific defects which will be of major interest in other plants.

Each sheet included in the coded stack was carefully selected in advance

and was known definitely to be either a prime or a second, or to contain one of the defects selected for study. The 150 sheets were numbered in random sequence. As the inspectors assorted the sheets, they called aloud their judgment of each sheet as to whether it was a prime or second, or contained one of the defects and, if so, which one.

As each operator assorted the 150 sheets, her judgments were recorded by an observer. She was also timed with a stop watch. This procedure resulted in data from which it was possible to determine both the speed and accuracy of the assorters studied.

The coded stack was scored for each girl according to the total accuracy on the 150 sheets and also for the accuracy on each of the specific defects. This resulted in 5 specific measurements of accuracy for each girl. It also resulted in a measurement of the reliability of each of the 5 methods of scoring the coded stack test. The 5 resulting measurements with their respective reliabilities are summarized in Table I.

Table I. The Five Measurements of Accuracy Yielded by the Coded Stack, with the Reliability of Each

Method of Scoring	*Reliability*
Mixed sheets	+ .90
Appearance defect No. 1	+ .86
Appearance defect No. 2	+ .87
Appearance defect No. 3	+ .68
Weight defect	+ .74

The reliability figures given in Table I were obtained by a standard statistical procedure and they represent the extent to which repeated or duplicate measurements of each girl by means of the coded stack test would result in the same score for her for the defects in question. If repeated measurements would give exactly the same score to all the girls on repetition of a given test, then the reliability of that test would be +1.00. If, on the other hand, the present scores given to the girls were entirely a matter of chance, and would bear no relation at all to repeated measurements on the coded stack test, then the reliability would be .00. It may be seen from Table I that the reliabilities vary from .68 to .90 which may be interpreted as meaning that the coded stack test in the form in which it was used measured the accuracy of each inspector sufficiently reliably so that a repeated test under the same conditions would not give appreciably different results.

As the inspectors assorted the coded stack, they were allowed to set their own speed or rate of inspection. This resulted in very great differences in speed. The time required for the various girls varied from 8 to 48 minutes.

It was first thought that this uncontrolled time factor would be a marked handicap to this method of measuring inspector accuracy. After careful consideration, however, it was thought best to retain an indefinite time limit procedure because only under such circumstances would we be likely to determine for each girl the maximum accuracy of which she was capable. In other words, the coded stack test was deliberately given under conditions which should cause every girl to bring to bear every bit of inspecting knowledge she has and, therefore, allow her to reach a level of accuracy which is close to, if not equal to, the maximum accuracy of which she is capable. It is recognized that in the actual inspection process on the job, few girls would reach this hypothetical level of accuracy. But it is also recognized that the coded stack results would indicate the ceiling or the maximum accuracy of which a given girl is capable and this was the primary purpose for which the coded stack test was given.

The results of the coded stack test as administered to the 150 girls are summarized in graphic form in Figure 1. The six curves shown in Figure 1 may be interpreted in the following manner.

The time curve in the upper left hand corner is so drawn that the height of the curve at each point indicates the number of girls completing the hundred and fifty sheets in each of the times specified along the base line. The most rapid assorter, it will be noted, completed the test in eight minutes, whereas the slowest required 48 minutes. The curve is highest over the region of 14 to 21 minutes, indicating that a plurality of the girls required between 14 and 21 minutes to assort the 150 sheets under the conditions of the test. The average time required, as indicated in Figure 1, is 20.1 minutes.

In the curve immediately below this the ordinate again represents the number of girls and the base line represents the percentage of accuracy for the entire stack of 150 sheets. The average accuracy for the 150 sheets given under the conditions of this test was, as shown in Figure 1, 78.5 per cent. This does not mean that the accuracy of these assorters in a normal assorting situation is only 78.5 per cent. The assorting skill required to inspect the coded stack is greater than that required in a normal assorting situation, because more defective plates of various types were included in the test than are found in the run of the mill, and the defective plates were not included in any sequence or groupings. The test as given measures differences among the girls in their skill on this job but probably gives to each girl a somewhat lower score, that is, a poorer accuracy, than she customarily reaches in routine daily assorting.

The remaining four curves in Figure 1 give similar distributions for the four specific defects studied. Figure 1 shows, among other things, that for

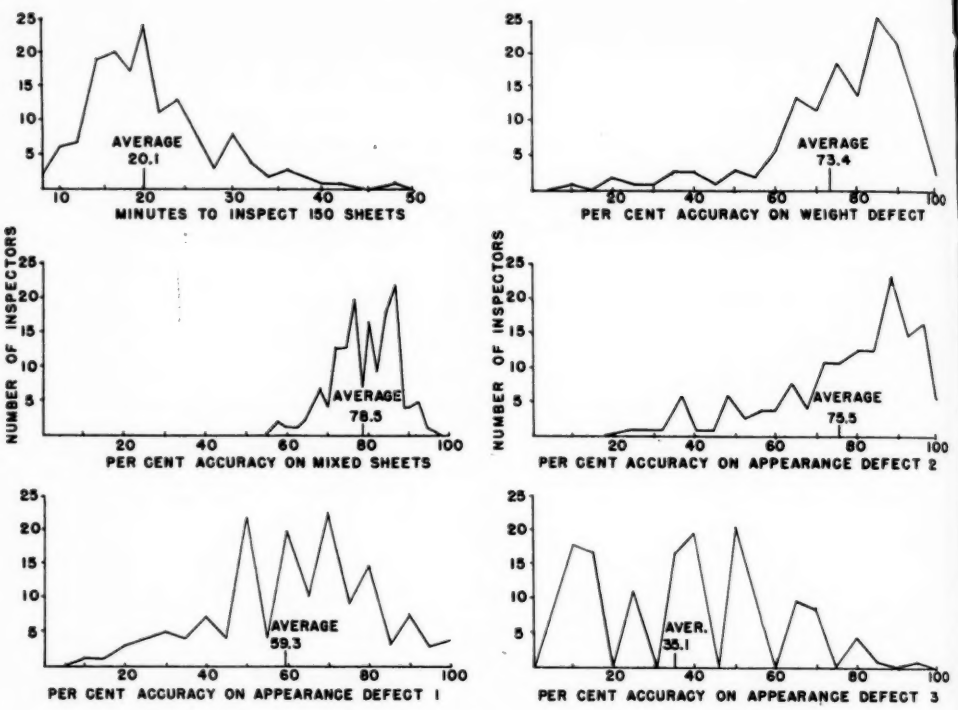

AVERAGE 20.1
MINUTES TO INSPECT 150 SHEETS
AVERAGE 73.4
PER CENT ACCURACY ON WEIGHT DEFECT
NUMBER OF INSPECTORS
AVERAGE 78.5
PER CENT ACCURACY ON MIXED SHEETS
NUMBER OF INSPECTORS
AVERAGE 75.5
PER CENT ACCURACY ON APPEARANCE DEFECT 2
AVERAGE 59.3
PER CENT ACCURACY ON APPEARANCE DEFECT 1
AVER. 35.1
PER CENT ACCURACY ON APPEARANCE DEFECT 3

Figure 1. Distributions of results on the coded stack test for 150 tin plate inspectors.

the four defects studied, the average girl is most accurate on appearance defect No. 2 (75.5 per cent), and least accurate on appearance defect No. 3 (35.1 per cent). The data also show that there is great variation among the various girls in their accuracy on any specific type of defect. For example, eight girls out of the 150 detected only 5 per cent of appearance defect No. 3, whereas one girl spotted 95 per cent of the sheets containing this defect. There is nearly as wide a variation in accuracy for the other four defects studied.

Inspection of Figure 1 also reveals that the amount of variation among the girls, that is, the range from the poorest to the best, is smaller for the curve representing total accuracy than for the several curves representing accuracy on specific defects. The reason for this is that there is only a very slight relationship between accuracy in detecting any one defect and accuracy in detecting other defects. Thus, if a girl is far above average in detecting one defect she is likely to be at average, or possibly even below average, in detecting other defects. This fact tends to give scores for the

total 150 sheets of mixed plate more nearly alike than the scores for the various individual defects.

It will also be noticed that the average accuracy on mixed plate is higher than the accuracy on any specific defect. This is due to the fact that a majority of the sheets included in the coded stack were primes or seconds, and the acceptable sheets were seldom called defective, whereas the defective sheets were frequently called primes or seconds. In other words, there was a tendency to overlook the defects. Hence, the accuracy for the total stack, which included a majority of primes and seconds, and a minority of defective sheets, was found to be higher than the accuracy on any specific defect studied.

The next question investigated was the relation between speed and accuracy in detecting the different types of defect. The results for this part of the investigation are summarized in graphic form by the curves in Figure 2. Each of the curves in Figure 2 is a logarithmic curve of best fit[1] representing the relationship between speed and accuracy. The equations of the curves shown in Figure 2 are as follows:

$$\text{Per cent accuracy on appearance defect 1} = 24.0 + 33.2 \log_{10} (\text{Time} - 7.5)$$
$$\text{Per cent accuracy on appearance defect 2} = 55.5 + 19.5 \log_{10} (\text{Time} - 7.5)$$
$$\text{Per cent accuracy on appearance defect 3} = 9.4 + 28.4 \log_{10} (\text{Time} - 7.5)$$
$$\text{Per cent accuracy on weight defects} = 72.7 + 5.6 \log_{10} (\text{Time} - 7.5)$$

In using these equations, it should be remembered that the word "Time" refers to the number of minutes used in assorting 150 sheets. It is understood that the percentages of accuracy which the equations yield are for the conditions under which the coded stack test was given.

It is interesting to note that in detecting off-weight sheets, the accuracy is about the same whether the test is completed in ten minutes or forty minutes. In other words, accuracy in detecting off-weight sheets for the 150 girls tested is not appreciably affected by speed of inspecting within the time limits found for these girls. To some extent the same general situation is true for appearance defect 2, although in detecting this defect we note a beginning tendency for accuracy to decrease with increased speed. This tendency is still more pronounced in the case of appearance defects 1 and 3. For example, we find that when the stack is assorted in ten minutes only 20 per cent of the sheets containing appearance defect No. 3 are spotted and only 35 per cent of those containing appearance defect No. 1. Since a time of ten minutes for 150 sheets is still faster than that used in the

[1] The curves were fitted according to the mathematical criterion of least squares.

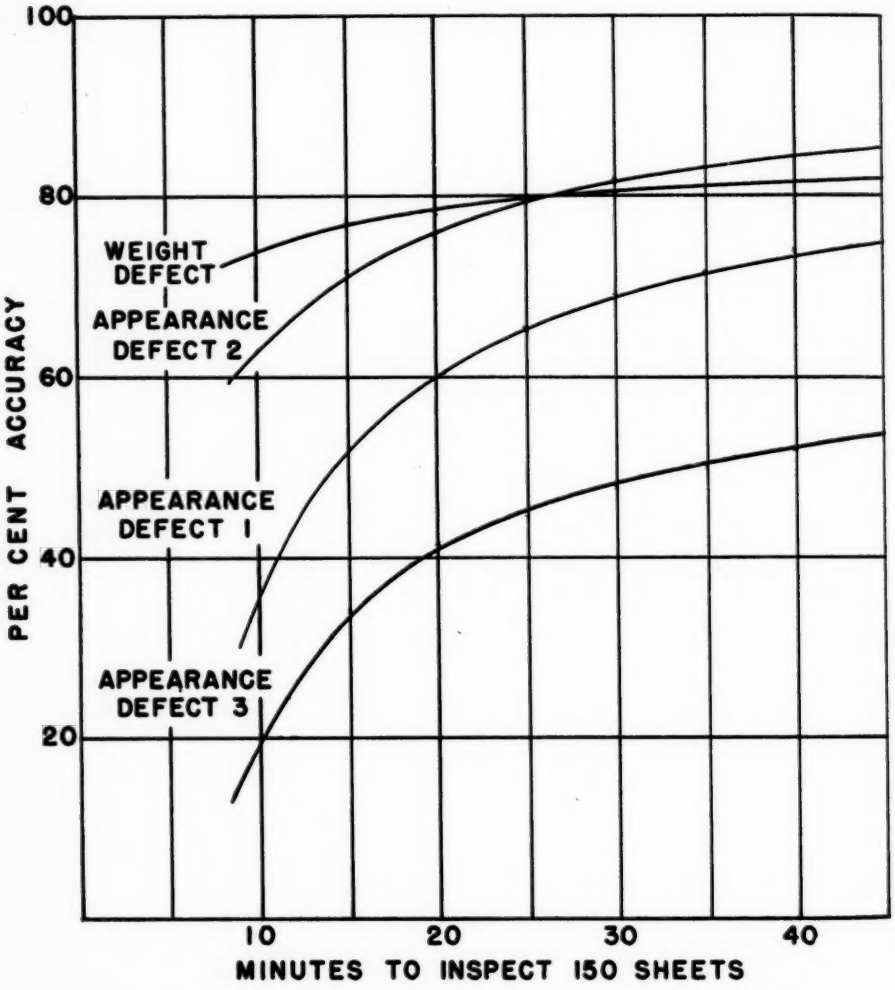


Figure 2. Relationships between speed of inspecting and accuracy in detecting four defects.

normal assorting operation, it is possible that the accuracy under normal conditions is no higher than the accuracy found on the test.

The coded stack test described above was accepted as the criterion for the purposes of the present investigation. The next step consisted of an attempt to find certain psychological tests which could be given at the time of employment and which would correlate sufficiently highly with the coded stack results to justify their use as a part of the selection program for employees on this job.

THE PSYCHOLOGICAL TEST BATTERY

The tests selected for the tryout consisted of a series of vision tests, the Minnesota Rate of Manipulations Test,[2] Purdue Hand Precision Test, and, in addition, measurements of reaction time, strength of grip, height, weight, and age. The vision tests were given stereoscopically, following the principles described by Wells.[3]

The Minnesota Rate of Manipulations test measures hand and finger dexterity. The Purdue Hand Precision test measures coordination between eyes and hand. Three holes each .5 inches in diameter, on the corners of an equilateral triangle 3.5 inches on a side, are successively uncovered by a motor driven rotor at the rate of 126 holes per minute. The person tested punches a metal stylus into each hole as it is uncovered. An electric timer summates the time the stylus is in contact with the rotor or side of the hole during the two minute testing period. The score is this summated time in seconds. The larger the figure, the poorer the score. Reaction time (time required to press a key after a light flashes) and strength of grip (average strength of right and left hand) were measured with standard laboratory equipment. The data on height, weight, and age were obtained from plant records. Each of these psychological tests was given to the 150 girls who had previously been given the coded stack test.

Table II summarizes the interrelations of the several tests in terms of the correlations[4] between them. According to the technique used for computing these correlations, the maximum value the figure theoretically could reach is +1.00. This would be reached in the case of a perfect positive relationship between the two variables under consideration. The minimum figure which the correlation could reach is −1.00, which would represent a perfect negative relationship.

The first figure mentioned in the table, it will be noted, is −.49, indicating the relation between speed and accuracy on mixed plate. This means that there is a tendency for those who are above average in speed to be below average in accuracy, and vice versa. It will be noted further that the correlations between speed and accuracy for the various specific defects are all negative, although the amount of negative relation between speed and accuracy on off-weight plate is the smallest found in this group. The intercorrelations between accuracy for the various specific defects are all small, the largest being only −.35. This substantiates the statement previously

[2] This test, and a manual describing it, are distributed by the Educational Test Bureau, Fifteenth and University Avenues S. E., Minneapolis, Minnesota.

[3] David W. Wells, *Stereoscope in Ophthalmology* (2nd edition; Globe Optical Company, 1918), 145 pp.

[4] These correlations are Pearson product moment coefficients of correlation.

Table II. Correlations of Test Results of 150 Tin Plate Inspectors

	Speed	Mixed Sheets	Appearance defect 1	Appearance defect 2	Appearance defect 3	Weight defect
Mixed sheets	−.49					
Appearance defect 1	−.42	+.80				
Appearance defect 2	−.49	+.68	+.24			
Appearance defect 3	−.36	+.58	+.35	+.21		
Weight defect	−.05	+.29	+.22	+.02	+.12	
Visual discrimination (distance)	−.26	+.22	+.28	+.16	+.19	+.02
Visual discrimination (near)	.00	+.09	+.08	+.13	+.15	−.10
Vertical balance of the eyes	−.43	+.03	+.25	−.13	+.08	+.01
Height	−.07	+.21	+.05	+.02	+.10	+.13
Weight	−.20	+.25	+.09	+.14	+.04	−.05
Age	−.11	−.16	−.09	+.03	−.12	−.21
Experience	+.05	−.05	−.07	.00	+.06	−.16
Strength of grip	+.02	+.17	−.05	+.19	−.07	+.14
Minnesota Rate of Manipulations	+.01	+.06	−.10	−.03	+.03	+.14
Speed of Reaction	−.02	+.12	+.05	+.10	−.07	+.03
Purdue Hand Precision	+.05	−.13	−.06	+.12	+.01	+.34

made that there is no decided tendency for girls who are above average in detecting one type of defect to be above average in detecting other types of defects.

The general conclusion which may be drawn from the correlations between the vision tests and the specific ways of scoring the coded stack is that the vision tests clearly tend to pick the girls who are the most accurate on the job. Although two correlations are slightly negative, the remaining thirteen are positive. The distance discrimination test gave the highest positive correlations against accuracy in detecting all three appearance defects.

The importance of vision in selecting the more qualified operators is more simply shown in Figure 3. In this chart are plotted the average time and average accuracy on the various types of defects for the girls with very good vision (in the columns indicated by A), of the girls with average vision (columns indicated by B), and of the girls with poor vision (columns indicated by C). It will be observed that as we go from the group with

good vision to the group with poor vision, the accuracy for the various types of defect usually tends to become progressively poorer. The one marked exception to this rule occurred in the detection of weight defects. Among the inspectors studied, the girls with poor vision were more accurate in spotting this particular defect than were the girls with good vision. Perhaps this is explained by the fact that this group has compensated for a handicap

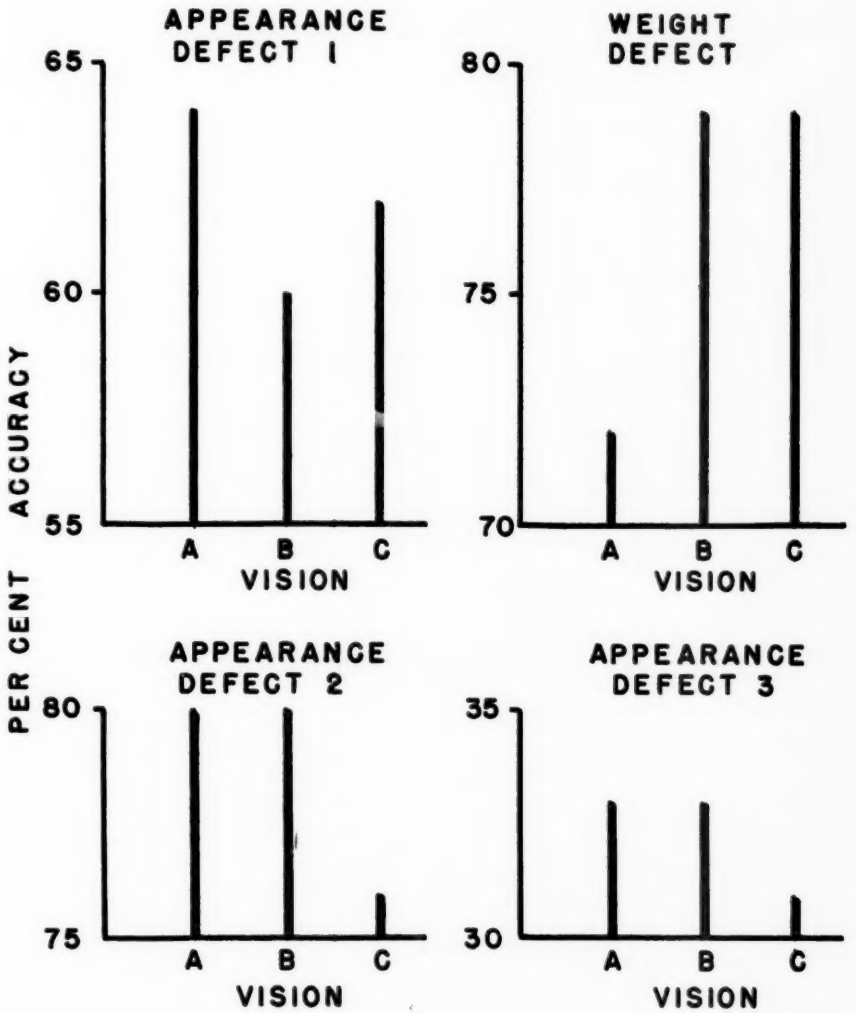


Figure 3. Accuracy of inspectors with good vision (A), average vision (B), and poor vision (C) in spotting four types of defective tin plate.

in one respect (visual) by developing greater than average skill for another aspect of the job where vision is not essential.

Table II also shows correlations between accuracy, as revealed by the coded stack test, and the height, weight, age and experience of the operators. It will be noted that there is a very slight tendency for taller girls to be somewhat slower than the shorter girls (correlations between height and speed —.07). There is, however, a tendency for taller girls to be more accurate on the several phases of the coded stack test, as indicated by the fact that the remaining correlations in this row are all positive. Likewise, in considering body weight we note that the heavier girls are somewhat slower, but more accurate on everything but off-weight sheets. The older girls, however, are not only slower, but less accurate on everything but appearance defect 2. The more experienced girls are slightly faster, but less accurate on nearly every defect.

Correlations between the remaining tests and the various ways of scoring the coded stack are given in the last four rows of Table II. While these correlations are somewhat inconsistent, there is at least one value shown in Table II which is high enough to indicate a definite and real relationship. This is the correlation of +.34 between the Purdue Hand Precision Test and accuracy in detecting off-weight plate. The hand precision test is recommended, therefore, for inclusion in a battery of employee selection tests as discussed in the last section of this article.

The reader may wonder why we have included in Table II those correlations which are so low that no significant relationships are indicated. The reason is to emphasize the fact that in setting up any battery of employee selection tests, it is always necessary to start with more tests than one expects finally to retain. Many of one's guesses are likely to be wrong. In the present experiments, the tests which were found of no value were strength of grip, Minnesota Rate of Manipulations, and reaction time. These represent the bad guesses in finding aptitude tests for the job. However, it should not be assumed that these tests are generally of no value, for they might be the very ones to "come through" best on some other job.

The general conclusions from the test results are obviously limited to the particular type of inspection that has been investigated, but the type of conclusion will give some indication of the kind of results such a procedure may yield.

1. By means of a coded stack of 150 sheets of tin plate, it is possible to measure the accuracy of inspectors with a degree of precision comparable to measurements of their height and weight.
2. The results show that there is a general tendency for high accuracy to be associated with slow speed of inspection and vice versa.

This tendency is most marked in the case of appearance defects. Curves showing the nature of the relationships between speed and accuracy are included.

3. Accuracy in detecting defective sheets is quite different for different defects and, in general, is lowest for defects in appearance which cover only a very small part of the total sheet area.
4. The range of accuracy for the different inspectors varies with the defect which they are attempting to spot. For appearance defect 1 the range is from 10% - 100%; for appearance defect 2, from 25% - 100%; for appearance defect 3, 5% - 95%; and for weight defects, 10% - 100%.
5. Tests of visual discrimination at near point and distance clearly indicate those inspectors who are most accurate in detecting appearance defects.
6. Of seven other measurements which would be obtainable at the time of employment, three (height, weight, and hand precision) were found related to accuracy on the job.

THE FINAL BATTERY OF EMPLOYEE SELECTION TESTS

A study and interpretation of the above data resulted in the setting up of four test qualifications which applicants for the job of tin plate inspector must meet in addition to the requirements set up by company policy. The requirements are:

1. Pass the near and far visual discrimination test, and the vertical balance test.
2. Be at least 5 feet 2 inches tall.
3. Weigh at least 118 pounds.
4. Score not over 2.00 on the Purdue Hand Precision Test. (See p. 21).

An indication of the effect of selecting inspectors upon the basis of these recommendations may be seen from the summary opposite which is based upon data gathered in this investigation.

The inspectors meeting the qualifications, though 5% slower on the coded stack, were from 4 to 15% more accurate in detecting the several defects. It might be suspected that, since the inspectors in the qualifying group were slower by 5% on the coded stack than the average of all inspectors, the greater accuracy of this group is simply a reflection of this slower speed. However, reference to the equations showing the relation between speed and accuracy (see p. 19) and the curves of these equations, plotted in Figure 2, shows that the speed differential would account for a maximum of 1.1% difference in accuracy, and this is considerably less than the difference

SUMMARY

	Average of all 150 inspectors	Average of 28 inspectors who met qualifications on four tests	Difference in favor of inspectors passing tests
Time to assort 150 sheets	20.1 min.	21.1 min.	5% slower
Accuracy on mixed sheets	78.5 "	81.7 "	4.1% more accurate
Accuracy on appearance defect 1	59.3 "	68.4 "	15.3% more accurate
Accuracy on appearance defect 2	75.5 "	83.1 "	10.1% more accurate
Accuracy on appearance defect 3	35.1 "	38.0 "	8.3% more accurate
Accuracy on weight defect	73.4 "	76.4 "	4.1% more accurate

in accuracy on any one of the defects. It seems conclusive, therefore, that the greater accuracy of the qualifying group is due primarily to the visual and other test characteristics of this group, rather than to the fact that they inspected at a slightly slower speed than the average of all inspectors studied.

At a time when accurate inspection is of paramount importance, the inspectors selected by means of this test battery would seem to be definitely more qualified to do competent work.

A MICROMOTION ANALYSIS

The discussion thus far has dealt chiefly with the statistical analysis of the data obtained from supervised tests on the coded stack and from various psychological tests described. It was desirable, however, to check these results with records of performance under actual shop conditions, and it was decided to make micromotion studies of representative operators.

Motion pictures were taken, at 1,000 frames per minute, of twelve inspectors selected from those who had taken the coded stack test. In this group were two who had been rated as fast and accurate, two fast but inaccurate, two slow and accurate, two slow and inaccurate, and four rated as about average in both speed and accuracy from the test stack data. The pictures were taken in the shop under normal working conditions, and because of the general noise and shop activity, the operators were not aware of the exact moment at which the pictures were taken.

Obviously the pictures could not check the accuracy with which the inspector detected the defects. However, they did show the normal speed of the operator, the relative body activity or exertion displayed, the various methods used in grasping and moving the sheets, and the disturbance in the rhythm whenever a defective sheet was found. In general the speeds

indicated by the analysis of these films correlated fairly well with the speeds indicated by the test stack.

One inspector had been selected who had shown extreme accuracy but relatively low speed on the test stack, but the film analysis indicated a very high speed when working under normal shop conditions. Previous production records also indicated high speed as well as high accuracy. Further investigation revealed somewhat similar situations for a few of the other operators. As an additional check, several all-day time studies corroborated the relationship between the departmental production records and the relative speeds indicated by the films.

The pictures were analyzed in an attempt to detect individual motion characteristics that might indicate causes for differences in accuracy. Since the detection of all but one class of defects depends upon vision, the eye fixations were plotted in relation to the positions of the hands and the positions of the sheet.

In the normal handling of the sheets the several stacks, respectively, of sheets which have not been inspected, sheets of first quality, those of second quality, and those containing various types of defects, are aligned along a bench. The operator picks up a new sheet from the pile at her left and turns it over toward the right onto the adjacent pile of first quality sheets, where it normally remains. If a defect is discovered, the sheet is moved to the proper pile farther along the bench.

For most of the operators it was found that the eyes tend to follow the movements of the hands. Thus as the hands move toward the left to grasp a new sheet, the eyes attempt to scan the full top surface of the sheet within the very short period of time required for the grasp. As the sheet is picked up and turned over onto the adjacent stack, the eyes tend to follow the movement of the sheet which, in the upright position, presents only one edge toward the eyes. As the sheet approaches the right-hand stack, the eyes attempt to scan completely the second surface of the sheet, but as the release period is very short in duration, the scanning period is likewise very brief.

In this sequence, the eyes are attempting to see an object that is almost continually in motion, and it was found that the operators who most nearly followed this pattern had the lowest accuracy ratings in the test stack data. This is logical since it is more difficult to see a moving object, and the continual attempt to do so reduces the accuracy of the operator.

On the other hand, the accuracy ratings were higher for those inspectors whose eye movements were more nearly opposite the above sequence. For example, the inspector mentioned above who was both fast and accurate according to the films and actual production records, used the following cycle of eye movements. As the hands moved to the left to pick up a new

SEQUENCE OF SHEET MOVEMENTS AND EYE-MOVEMENT PATTERN

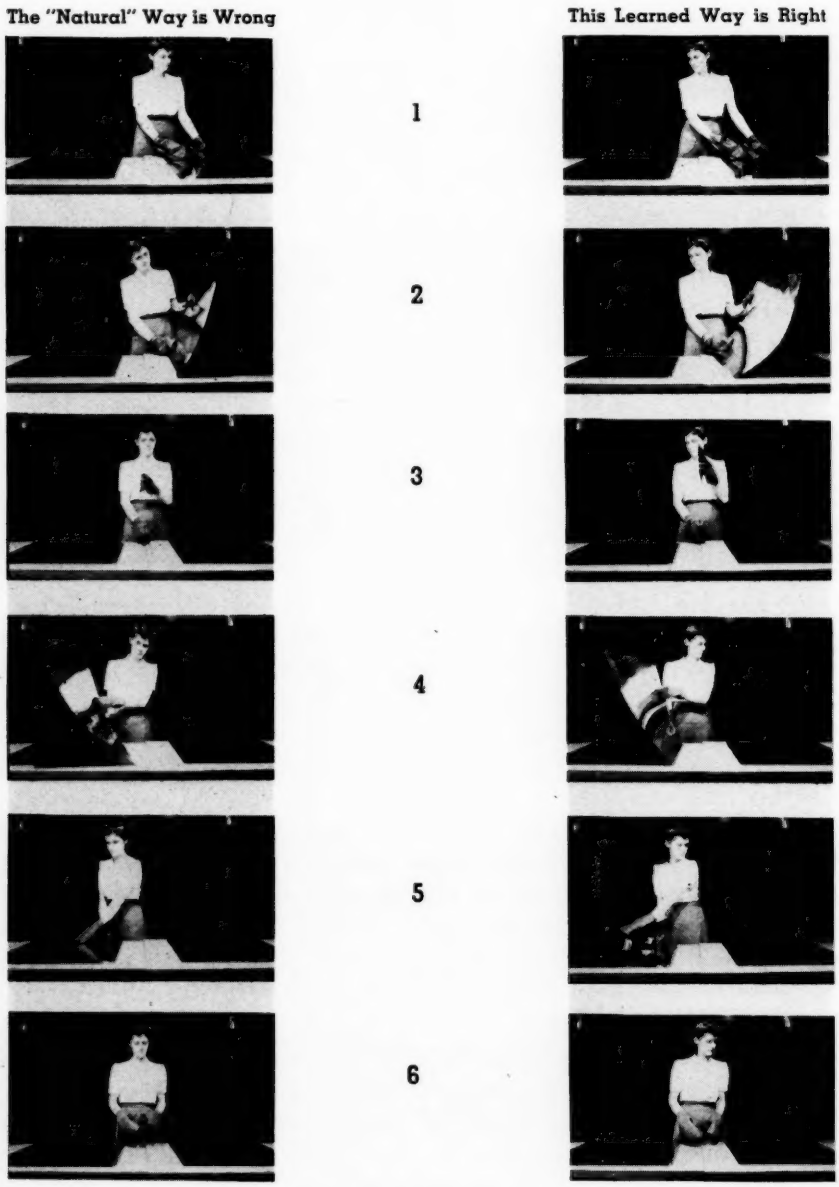


Figure 4. In the "Natural Way" the eyes follow moving objects. The inspector thus sees the full sheet only in steps 1 and 5; she tries to see it while it is in motion in steps 2 and 4; she sees only the edge in step 3; and merely watches her hands in step 6. In the Right Way, which must be learned, the inspector sees a motionless sheet during all 6 steps. This nearly doubles the available inspection time.

sheet, the eyes were scanning the second side of the previous sheet. The fact that this previous sheet was not in motion contributed to the ease of seeing possible defects, and the scanning period was increased to include nearly the full handling time of the next sheet. When the next sheet approached the second pile to the right of the operator, the eyes quickly shifted toward the left, to the first side of the top sheet on the new pile where the scanning period included the time for disposal of the previous sheet. (See Figure 4.)

In this second cycle of eye movements, the eyes move quickly from one motionless object to the other and have greatly increased scanning periods for detecting the finish defects. Accuracy data both from the test stacks and from production records correlated very closely with the eye movement patterns of the twelve inspectors thus analyzed.

It has been demonstrated experimentally that the eyes can see a motionless object more accurately than one that is in motion, and the longer the scanning period, the more opportunity there is to observe defects. If the increased scanning periods are longer than necessary for effective inspection, the operator tends to handle the sheets faster. It is logical, therefore, that the girl who, accidently or otherwise, had acquired this improved routine should be both fast and accurate.

This cycle is opposite the more natural cycle of following the hands with the eyes, but as in many other operations, the natural way is not necessarily the best way. This less natural, but more effective coordination of the eyes and hands is simple to learn, but being less natural, its technique must be explained and taught to the operator along with the other requirements of the job. This might be classed as one of the "tricks of the trade" not readily discovered without adequate instruction.

THE TRAINING OF INSPECTORS

Several specific needs for training came out of the above experimentation. In the first place, the accuracy of inspectors on the job was found to be far from the level of satisfactory performance which both management and supervision considered desirable. Reference to Figure 1 shows that in the case of some of the defects, an appreciable number of the present employees were unable to spot over 10 or 20% of the defective material. The relationship discovered between accuracy and visual capability resulted first of all in the recommendation that those girls low in accuracy on defects of appearance immediately see an eye specialist and be fitted with proper spectacles. Subsequent analysis of inspection results in the plant revealed that those girls who were fitted with adequate spectacles were doing a more

satisfactory job of inspection than those girls not fitted at all or improperly fitted.

A second effort made to upgrade the performance of employees on the job consisted of a series of inspectors' conferences. The inspectors were brought into conference in groups of approximately 20, on company time. The first thing done in each of these conferences was to pass out a slip to each girl on which was printed her accuracy on the coded stack as a whole and on each of the four specific defects studied. This information gave each girl a clear indication of her weak as well as her strong points and resulted, in most cases, in a definite desire on her part to improve her level of performance. The fact that there was very little correlation between accuracy on the different kinds of defects resulted in the fortunate circumstance that a girl who was very low in accuracy on one defect, or possibly even two defects, was likely to be average, or even above average, in accuracy on the other defects. This, coupled with the fact that there were very few girls who were not low in accuracy on at least one defect, prevented any employee from feeling that she had been singled out because of her low quality work. Each girl investigated came to two of these training conferences, which lasted an hour and a half each and were separated by a period of two weeks. The time was spent in thorough discussion and demonstration of the various kinds of defects found in tin plate. The demonstration also included a review of the micromotion films and an explanation of difference between the patterns of eye movements with respect to the moving sheet. The films illustrated these eye movement patterns and provided a means of teaching the most effective sequence of visual fixations. General improvement in performance following these conferences was uniformly considered sufficiently great to justify the conferences.

The second innovation of training procedures which directly resulted from the investigation herein reported dealt with the training of new employees. The procedure followed in the past consisted in placing a new girl between two experienced inspectors. The expectation was that new employees would be able to ask questions of the more experienced employees. The present results indicated that this procedure had not resulted in adequate training of new inspectors. Since hindsight is often better than foresight, it is easy to see now that the experienced operators do not wish to be bothered with stopping frequently to answer the questions of a new girl. This resulted in each new employee finally setting up her own methods and standards of performance, and it is not surprising that under such circumstances the standards varied so markedly among the employees on the job. The new procedure consisted in assigning an experienced and capable inspector as an instructor to each group of four new employees.

The old employee was taken off the job of inspection in the sense that she had no assigned work to perform, and was able to devote all of her time to the actual instruction of the new employees. This resulted not only in much more uniform standards of inspection among the newer employees than had heretofore existed, but also in a marked reduction of the time necessary for bringing a new girl up to a satisfactory level of performance. As the newer girl becomes more adjusted to the job, less and less time of the instructor is called for, and after a certain level of efficiency is reached, the instructor automatically resumes her former quota of work. Under this system the older employees assigned as instructors take a considerable pride in the fact that they had been selected for this job of breaking in the newer inspectors and the method has been favorably received both by the older employees and the newer employees, as well as by management and supervision.

The general conclusions which seem justified from this work are that if adequate inspectors are to be obtained they must be selected with scientific precision and trained with corresponding thoroughness. No amount of desire on the part of a new employee to be a good inspector will result in satisfactory job performance if the employee does not have the visual qualifications, the necessary eye-hand coordination, or the physical stamina which experiments show to be necessary for the job. And in like manner, no amount of qualification for the job will result in satisfactory performance without a systematic training program covering standards, procedures, as well as "tricks of the trade." The procedures outlined in this article have accomplished these results in the job of tin plate inspection. There is every reason to believe that they will also be of value in the selection and training of employees for other kinds of inspection jobs.

SUPERVISION OF APPRENTICES

By O. L. HARVEY
Technical Analyst on Apprenticeship, Division of Labor Standards
United States Department of Labor

In this, the fourth of a series of articles on apprentice training, Mr. Harvey details the various responsibilities of the apprentice supervisor. The different points that he discusses are the practical considerations encountered in supervising any apprentice program. His recommendations are based on a long period of observation of the apprenticeship experience of many companies.

WITHOUT adequate provision for expert supervision an apprenticeship system has little value. Any intelligent youth, given scope and sufficient time, can pick up a trade; but, unless he is exceptional, his knowledge is poorly organized, he lacks occupational discipline, and his trade judgment matures only late in life. His fellow-workers will instruct him to some extent; his employer might possibly offer him facilities in gaining varied and skillful experience; and he might, if he is persevering, find information in schools and books. But his success, if any, is due to his own initiative stifled by circumstance and relieved only by accident. More often than not his mental growth and manual skill are stunted, merely because he never got the right opportunity to learn.

What he needs most is opportunity, and that means supervision. Supervision is like a catalytic agent in chemistry. It adds nothing to the brew, and remains unchanged throughout; but it brings about a combination of elements in the right proportion to yield the perfect product. So in the training of skilled workers. The function of the supervisor is to arrange the various influences that operate on the apprentice in such a way that he may benefit from them to the greatest extent at the right time. Expert supervision is fundamental to sound apprenticeship.

Now, apprentice supervision does not necessarily call for the employment of a supervisor of apprentices – that is, an official specifically and solely limited to the performance of this function. In many of the smaller plants, and especially in job shops, administrative costs prohibit the employment of such a person. In such a case it is recommended that the function be allocated as part-time duty of one of the foremen or other management officials. In production plants, on the other hand, and especially in those which employ many apprentices, it is usually found to be economical in the

long run to place the responsibility for apprentice supervision in the hands of one man specially designated and specially equipped to do that type of work.

Whatever the size of the shop, the general principles of apprentice supervision remain approximately the same. Consequently, although what follows is intended to apply in the main to large production shops, the argument will apply, though perhaps with some qualification, to small shops as well.

SUPERVISOR'S FUNCTIONS

What, in detail, are the functions of the apprentice supervisor? They may be listed and briefly described as follows:

a. *Selection:* Out of the many young men seeking employment few are suitable apprenticeship material; some lack sustained interest in the trade, others lack the necessary physique and health, and in many cases aptitudes and skills reveal the fact that the youth would be better fitted for some other kind of occupation. The supervisor's first job, then, is to select the best, with an eye to present costs and future returns. Some supervisors place great emphasis on the use of special tests and school examination results; others prefer to depend on personal interviews checked against the impressions of other people acquainted with the candidate; and most feel that the best test is a trial period of employment. Some adopt the policy of giving preference to those candidates who are related to and vouched for by other workers in the plant; others maintain a strictly objective viewpoint, and insist on selecting only the applicant with the best job-qualifications. No one method has proved best; and eventually all of them, in the last analysis, appear to hinge on the good judgment of the supervisor. Useful assistance can be rendered by the public vocational schools, which could subject young people to trade orientation courses in which to determine potential interests and abilities; but, in the final analysis, the success of the program depends on the methods and skill in selection used by the supervisor of apprentices.

b. *Employment:* Having selected, the supervisor arranges for the employment of the successful candidates. This requires that he know where suitable jobs in the plant are available. In some plants such information is provided by the personnel department; in other words, the decision to employ a new apprentice is made by someone other than the supervisor. By contrast with this policy, the practice of some plants is to place the necessary authority with the supervisor of apprentices. Not only does he employ new apprentices when vacancies occur; but also he decides when and where

to employ additional apprentices regardless of vacancies. Obviously this broader responsibility involves considerable discretion; it means that the supervisor must be able to estimate the future skilled-worker needs of his employer, and to convince the various shop foremen that his policy is sound.

The supervisor then initiates the new apprentice. He explains the company's apprenticeship policy; if that policy includes the use of a written indenture, he draws it up for signature by the apprentice and the employer. He arranges for the provision of tools and other equipment, checks the boy in through the time-office, and allocates him to his job.

c. *Allocation:* The shop foreman is boss in his own territory. He is responsible to the general superintendent, but to no one else. Consequently, the relationship between the supervisor of apprentices and the shop foreman is one of a delicate nature. Each has a claim on the apprentice, but from different points of view; the foreman has to produce, whereas the supervisor is concerned with training. So that both may be satisfied, it is necessary that their relationship be friendly and that each have confidence in the other's sincerity, judgment, and ability. The wise apprentice supervisor will never even attempt to insist on introducing a new apprentice into a shop without the willing cooperation of the foreman. And if a foreman wants no apprentices in his shop, the only thing the supervisor can do is wait until that particular foreman is "sold" on the value of an apprenticeship program. This might be done through foreman conferences. In the event of a dispute, of course, the general superintendent may be requested to make a decision; but administratively such appeals are to be avoided. The supervisor must sell his case directly, or fail. And his best selling point is proof that apprenticeship works and pays for itself.

d. *Routing:* The routing of apprentices from one type of operation or machine to another should be in accordance with prescribed practice. In other words, the question as to whether or not it is due time to shift an apprentice to a new kind of experience should be determined not as a result of compromise between supervisor and foreman, but because the rules laid down for training so provide. The value of a prescribed schedule of work processes applicable to all apprentices in any given trade in the plant is thus apparent. The foreman and the supervisor might both have been consulted in setting it up – participation also by top management officials and representatives of the workers is recommended – but, once approved, it becomes final. The only direct concern thereafter, for either foreman or supervisor, is to see that the schedule is adhered to. However, it is the supervisor's job to direct the actual routing and arrange for the necessary transfer.

Usually a certain amount of leeway, provided for in the schedule itself, makes this possible without undue friction or inconvenience. The schedule specifies the amount of time to be spent on learning each process, but it also states that the processes listed do not necessarily have to be learned in a fixed sequence. Thus, if not convenient to transfer an apprentice from process A to process B, he may be transferred to process C; or he may even be transferred for part of the time to C, then to B, and back again to C, until such time as the time limit allowed has been reached. Furthermore, the schedule sometimes provides that the apprentice may, for a brief period, be assigned to operations not specifically provided for, or in which additional experience is thought desirable. Thus, an apprentice who needs further training on a given type of machine may, within limits, get that training. Or an apprentice of exceptional ability may be permitted to work, similarly within limits, on a machine in the operation of which he is particularly interested. Such decisions, however, should be made by the supervisor on the basis of what would give the best possible training to the apprentice.

As a result of the flexibility thus provided for in the schedule, the routing of apprentices can be varied. Consequently, the supervisor of apprentices, who has as his function the administration of the schedule, can adapt the program to some extent to the special needs of production, even while still conforming to the more rigid requirements of the training program as a whole. This margin of adjustment greatly helps in maintaining cordial relationships between the supervisor and the various foremen, with distinct advantage to the apprentice himself.

e. *Coordination:* Coordination of the apprenticeship program is highly technical and is, properly speaking, a primary function of the supervisor. It is especially important in a large plant employing many apprentices. New apprentices are taken on at different times, with the result that their schedules overlap; or one shop has a rush of work, and another is temporarily slack; or only a certain number of machines is available in a given shop for use in training the beginning apprentices; or, to meet an anticipated considerable increase in business activity, a number of new apprentices are going to be employed, and some arrangement has to be made for their distribution throughout the shops in such a way as to avoid a sudden drop in the number of apprentices some three to five years hence. To meet any of these problems successfully is to be an effective coordinator. It calls for a high degree of skill in arranging time-tables, as well as the ability to forecast future trends and organize a program that will be as effective four years hence as it is today. Assistance from the personnel division is avail-

able, and the foremen offer their utmost cooperation; but in the long run it is the supervisor who is responsible for the blueprint, the development of the plan. Attention to detail is a fundamental requisite. At the same time, however, the supervisor has to coordinate the more general aspects of his work: keep the management informed; maintain cordial relations with foremen and skilled workers; gain the confidence of his apprentices; and cooperate with State school authorities and State labor department authorities.

f. *Evaluation:* To assign the apprentice to a job, transfer him when due for the next one, and then leave him to his own resources is not supervision. It is still necessary that his progress be systematically checked, and that he be given suitable guidance as he goes along. His work must be evaluated, but no one source of information on the apprentice's work is entirely reliable. The gross picture of his progress must result from contributions made from many different sources: the foreman (or foremen) under whom the apprentice has worked; the skilled workers who introduce him to his various jobs; and the instructors who provide him with related school instruction. The supervisor must arrange to get reports from all of these sources, check them against his own observations, and resolve them into a single and consistent comment that will be both just and informative. If customary, he must also make arrangements for a formal examination of the apprentice's work. And all this he must do preferably at regular intervals not too far apart. The most suitable times usually coincide with those specified in the schedule for promotion of the apprentice from one wage rate to the next. At such times the supervisor must have all the information necessary on the basis of which to make his decision and to take any disciplinary action that may be indicated.

g. *Recording:* Records are a necessary evil; but without them the supervisor is helpless. His problem, therefore, is to establish a records system which will be as efficient as possible, but entail the minimum of effort and fuss. The fact that such a variety of different systems is actually found in practice, ranging all the way from primitive simplicity to great complexity, merely reflects the fact that no two supervisors think and work alike. It also suggests the need for technical research. On the other hand, as an examination of prevailing methods will show, throughout all of these systems certain fundamental records persist; they include application forms, time sheets, ratings, a master record, and the apprentice indenture form. Each form must be developed to meet the needs of the specific situation. But some help can be obtained from the national clearing house on apprenticeship – namely, the Federal Committee on Apprenticeship, Division of

Labor Standards, United States Department of Labor, Washington, D. C.

h. *Discipline:* In industry the most common method of discipline is dismissal. Nevertheless, despite its convenience, it is clumsy and, in large measure, unnecessary. It represents the acknowledgment of failure to solve a problem, which, had it been treated earlier, need never have arisen. Recognizing this fact, the more observant employers have established methods by which the development of disciplinary problems is forestalled; and, in the administration of their apprenticeship programs, they exemplify the best characteristics of this procedure.

When an apprentice fails to "produce the goods," is impertinent, develops bad habits, is lax in attendance at school, wastes materials, or experiences difficulty in understanding instructions, he needs advice and correction. Under the old system he would be immediately discharged. And the foreman made the decision. The more modern and intelligent procedure authorizes the supervisor of apprentices to handle the case.

The supervisor observes the boy at his work, studies his past record, talks things over with the apprentice's fellow-workers, discusses his progress with the foreman and the school instructor, and calls the boy in for a conference. The value of a brief probationary period, in this connection, is at once apparent. The problem may be quite simple: difficulties at home, a hasty temper, gambling habits, a misunderstanding with the foreman, etc. In which case, the remedy is also relatively simple. In more complex cases, several different contacts and approaches may have to be made. But, in every case, the fact that the supervisor is *in loco parentis,* (though in an objective way), and at the same time on a friendly relationship with all of the parties concerned, makes adjustment possible. He is not motivated by a sentimental concern in the boy's welfare; it is his job to save unnecessary expenses and obviate sources of friction. And he knows, as well as any, that an apprentice is a valuable product. Flat dismissal of an apprentice, in whom money and time have been invested, is merely wasteful; if he can be reclaimed, or transferred to some more suitable trade, the expenditure of a little time and effort should be worthwhile. The supervisor, in his role as counselor is a conciliator, and a valuable conciliator at that. No more dramatic proof of his value can he offer than to be able to point to a certain man and say: "Six years ago that man was an apprentice about to be fired. But I was able to clear up his problem, and we kept him on, with the result that today he is one of the most highly skilled and respected workers we have in the shop."

i. *Social and Recreational Leadership:* Many up-to-date plant apprenticeship systems employing a supervisor of apprentices provide facilities for

the development of an apprentices' club for social and recreational purposes. Whether or not this is a desirable practice depends upon one's point of view. Its chief defect is that it suggests that apprentices are more closely associated with the management than with the working force as a whole, and thus operates to the detriment of the company's labor relations policy. Its chief advantage is that it enables the supervisor to get to know his boys more intimately and thus the more effectively to understand their problems. If in some way these two possibly opposed values could be reconciled, the social and recreational function of the supervisor would be greatly enhanced. It is at present so closely tied up with the broader problem of labor relations, however, that no adequate assessment of its worth can be made. It is reasonable to suggest, however, that, if the formation and promotion of an apprentices' club could be conducted as an enterprise jointly approved by both the employer and the workers in the plant, its value as a stimulus to the apprentices would be vastly augmented.

j. *Graduation:* Making arrangements for the graduation of his apprentices is the most pleasant of the supervisor's functions. In every respect they are "his boys," the living proof of his success as a supervisor. It is the usual custom, therefore, to make this occasion one of celebration. Periodically, all apprentices who have graduated during the interim since the latest graduation day are invited, together with their parents and friends, to a banquet. Senior officials of the company, representatives of the plant labor organization, school officials, and other persons interested in apprenticeship are also present. The banquet is followed by a speech from one of the guests, and engraved certificates of completion of apprenticeship are formally presented to the graduates.

As a parting gesture, and provided that the company's training program and labor relations policy are as good as the banquet, graduating exercises are very effective as a way of sealing the good-will that exists between the apprentices and the company. The graduating apprentice, it should be remembered, is not only an employee but also a potential salesman. Where he goes he carries the company's name; and as he behaves so the company and its products are judged. For the graduate to be able to look back with pleasure to his relations with the company is one of the best measures of the effectiveness of the apprenticeship policy and program existing in the company.

ADMINISTRATIVE RESPONSIBILITIES

Exercising the various functions described above, the supervisor of apprentices holds what is obviously a significant place on the company's

administrative staff. His status as an official, therefore, should be somewhat precisely defined.

Mention has already been made of the supervisor's relationship to the shop foremen. Both are directly or indirectly responsible to the top management; and both are concerned, though from different points of view, in the supervision of apprentices. However the supervisor is also, in many instances, attached to the personnel department, to the director of which he is responsible. And finally, in some plants he is himself the personnel director with responsibility to the president, in which case his status is approximately equivalent to that of the general superintendent. The question of defining the lines of administration is, therefore, important.

As a general principle it seems to be desirable that, in all matters of apprenticeship, the general superintendent should be the final authority in the event of any difference of opinion between foremen and others on the one hand and the official in charge of apprentices on the other. Within those limits, however, the job of establishing and administering the apprenticeship program should be assigned without reservation to the apprentice supervisor. He should be instructed to cooperate with the production officials and give full consideration to their suggestions, but in the final analysis he should have complete authority to make decisions. Appeals over his decision to the general superintendent should be discouraged; at the same time his work should be evaluated in part in terms of the extent to which he is able to maintain diplomatic relationships all round.

If he is attached to the personnel department, but is not himself its director, the supervisor should be required to make reports to the director, and consult the director with respect to those broader phases of the apprenticeship program which might have bearing on personnel policy as a whole. But it should clearly be understood that the supervisor, and not the director, is responsible for the apprenticeship program.

The relationship between the supervisor and the foremen has already been indicated. Its success will depend upon the extent to which each has the confidence of the other. But the importance of a friendly relationship between the supervisor and the skilled workers in those shops employing apprentices should not be overlooked. Indeed, there are grounds for arguing that this is one of the most important of the supervisor's responsibilities. Some apprentices will become administrative officials, but the large majority will become skilled workers. During their training period they will be in intimate daily contact with adult workers from whom they will learn most concerning the finer points of their trade. And at all times the keenest critics and judges of their workmanship will be the mature workers in the same shop, who, if it be an organized shop, will eventually determine

whether or not the apprentice may be admitted as a member of their organization. Obviously the present and future welfare and recognition of the apprentice as a worker depends in large measure on the attitude of his co-workers. For at least this reason there is wisdom in establishing cordial relations between the supervisor and the workmen. Still more is this relationship desirable, because of the exceptional contribution the skilled workers can make in advising on the type of training the apprentice should receive, and in supporting the apprenticeship program that the supervisor is trying to effect.

It is recommended, therefore, that the skilled workers in the plant be invited to collaborate with the management in setting up and administering the apprenticeship program. The usual procedure, in this connection, is to establish a joint apprenticeship committee for the plant as a whole, comprising, in equal proportion, representatives of the management and representatives of the skilled employees in the apprenticeable trades concerned, with the supervisor as secretary of the committee. The committee would establish the apprenticeship program in broad outline, determine what the apprentices in each of the several trades should learn, advise the supervisor in disciplinary problems, examine apprentices periodically to see that they are fulfilling the terms of their apprenticeship contract, and cooperate with the school instructors in outlining suitable courses of study. Such a committee has distinct advantages. It does not, in any sense, take away from the functions and prerogatives of the employer; but it serves as a most valuable aid. In organized shops it should preferably be distinct from the arbitration committee, in recognition of the fact that apprenticeship is essentially a training problem, entirely different from the other issues of employment. In unorganized shops, in which representation by the employees is not possible because of lack of organization, it could be effected as a management committee in cooperation with a local or State joint apprenticeship committee, such as the State apprenticeship council, on which employers and organized labor are represented. In either case the important points to remember are: that a joint apprenticeship committee can be of inestimable value; that apprenticeship is essentially a training program in which management and labor have equal interest; and that the primary issue at all times is the welfare and training of the apprentices.

CHARACTERISTICS OF SUPERVISOR OF APPRENTICES

A successful supervisor of apprentices, as suggested throughout the preceding discussion, is an unusual man. He must combine sound educational concepts with a thorough knowledge of the technical aspects of shop work. Essentially a practical man, with experience in actual shop work as a

skilled craftsman, he still must be able to appreciate major problems of policy and administration. Unless he is diplomatic and tactful he will fail to accomplish his objectives; nevertheless, he must have the intelligence and the will to hammer out his ideas on the anvils of other people's minds, and press them through to effective action when formulated. Essentially a leader of both boys and men, he still must act as though he were the vehicle for the decisions of others; and all the time he has to beware of developing that air of omniscience which, like a halo, seems to develop round the heads of those in daily contact with youth. Without a genuine personal interest in the boys under his charge, he cannot hope to be successful; nevertheless, at all times his judgment must be subject to the reservation that his main job is to ensure the best quality of workmanship.

In this last connection, however, the question of his sales and promotional value is raised. Probably more than any other official of the management, the supervisor of apprentices represents the very essence of the company's public and labor relations policy. The company's reputation depends on the quality of its products, and that in turn on the quality of its skilled workers. But the skilled workers are the product of the company's apprenticeship program, which depends in turn upon the supervisor of apprentices. What he produces, over several decades, will eventually constitute the very rock upon which the firm is built. He cannot afford to be slipshod. At the same time, it should be remembered, the company's reputation depends, in large measure, on the attitude of its skilled workers. Men will seek employment elsewhere; salesmen of technical equipment and the company engineers, who meet consumers of the company's product the world over, carry with them the stamp of the company that trained them. If they are incompetent, if they are contemptuous of the policies of the company they represent, if they lack faith in the quality of the goods that the company produces, no matter how loudly they may proclaim the excellence of that company, their arguments will always lack that fundamental sincerity which, in the long run, finally persuades the customer to sign on the dotted line. And these men, too, are the products of the apprenticeship system. Fame and reputation do not grow out of thin air; they are built up slowly; brick by brick, out of the contributions of myriad workers and meticulous attention to detail. In that building the supervisor of apprentices has a significant contribution to make, but only in so far as he conceives of his product as the men who do the actual work. In training apprentices, then, let him not forget that, in the long run, his success and that of his firm depend upon the cooperation of the working force as a whole.

SELLING A RATING PLAN

By EDWARD N. HAY
Personnel Officer
The Pennsylvania Company

An effective employee merit-rating plan must meet the test of practical use by the operating organization; indeed, more rating plans fail from lack of executive support than from any technical defect. Thus "selling" a rating program to top management and supervisors is as essential a step as formulating its details. In this article Mr. Hay outlines the various steps involved in launching a rating plan, and indicates specific situations in which rating will prove its effectiveness.

AN EMPLOYEE rating plan is of no value *per se;* it must be created in response to a recognized need by the operating organization. Ratings that are merely an accumulation of records in the personnel file are of little worth. They must serve a genuine purpose, and that purpose is *maintaining a strong organization.* Three things must be done in order to keep the organization as strong as possible:

1. Retain the competent employees.
2. Promote the superior ones.
3. Eliminate the unfit and in times of layoff drop the least valuable.

Ratings bring to light the facts necessary to identify the superior, satisfactory and unfit employees.

INSTALLING A RATING PLAN

Before attempting to install a rating plan, the executives and supervisors of the organization must perceive a need for it. The only way they can recognize that need is to become aware of problems whose solution is facilitated by formal systematic rating. Thus, the starting point in instituting a rating program is to get the organization to recognize the existence of problems and to show that rating will help to solve them.

An argument in favor of formal employee ratings is that each time a person is promoted, transferred, dismissed, or receives a salary increase, this action is the result of an informal and sometimes unconscious estimate of the employee by his superior. In a large organization it is desirable that such decisions be arrived at in a uniform manner, and as a result of information received from several sources, in order to avoid prejudice and discrimination or to prevent undue leniency. Furthermore, it is becoming increasingly necessary that the facts which underlie an important decision be recorded in permanent form. For example, under many union agreements some written evidence of the basis for dismissal must be available.

Wait for the right opportunity to suggest employee ratings. In one company, this opportunity presented itself when a number of employees of long service were separated from the payroll for inefficiency. It was said of one of these that throughout his entire 26 years of service he was known to be unsatisfactory and unwilling to do his share. Discussion among senior executives of cases like this naturally aroused inquiry as to whether some of the shorter-service employees might not be unsatisfactory and in future years present problems whose solution would be more painful the longer postponed. In an atmosphere such as this, it was easy to suggest that all new employees be reported on systematically by their supervisors so that attention might be drawn to those doing unsatisfactory work. This would permit correction or dismissal without injustice before the problem had become too acute.

RATINGS AND SALARY

Elimination of the unfit has been cited as an illustration of problems that can be solved with the aid of ratings. Another function in which ratings are useful, and indeed essential, is in the administration of salaries. While ratings can be used for this purpose without any formal plan of salary classification, the establishment of a formal classification plan is one of the easiest ways to introduce ratings. This is because proper salary management involves three steps: (1) What are the duties of the job? (2) What is its salary value? (3) How well does the person performing the job do it? As will be seen, the third of these steps is covered by formal rating. Logically, therefore, the first two parts of the plan, which may be described as the job analysis and position evaluation, should be completed before the third step, rating the employee, is undertaken.

In one company this procedure was followed and the personnel director avoided any mention of rating until the salary classification plan had been completed. He then drew the attention of supervisors to the need of ratings in order to determine whether an individual employee deserved an increase in his current salary and to compare his merits with those of other employees. Since the logic of this argument was apparent, it greatly smoothed the path toward adoption of a formal rating plan.

RATINGS AND PROMOTION

The identification of employees most suited for promotion is facilitated by ratings. For example, Thompson received his promotion to a key job, for which the department head thought he was too young, by reason of the fact that his ratings over a period of two years had indicated outstanding performance and faithful attention to his duties. This, combined with

evidence of marked ability in psychological tests, enabled the personnel director to persuade the department head to give Thompson a trial. In no time at all he had more than justified the recommendation and is now one of the most successful men on the job. The ratings were an essential step in giving him his chance, and without them it would have been more difficult to demonstrate the high quality of his performance in his previous positions.

RATINGS AND TRANSFER

Frequently transfer becomes necessary as a result of the failure of an employee on a specific job. Sometimes an individual is assigned to a task for which he is not well suited or which he does not like, and he thus renders an unsatisfactory performance. In such case formal ratings serve to bring out defects and also permit giving credit for good qualities. When a personnel director has available a variety of ratings, made by different raters at different times, along with the scores of psychological and other tests, it is often possible to reassign problem employees to other positions in which they will prove satisfactory.

For example, Peterson was an instalment collector who was brought into the office for a more important position because of the good work he had done on the street. However, over a period of six months his performance in the office was unsatisfactory and all efforts to help him failed. The rating reports sent to the personnel department included such comments as these: "Does not learn"; "Asks the same questions time after time"; "Unable to think fast." The personnel director examined the man's test scores and found them to be much below those ordinarily required for a position of such responsibility. Peterson simply lacked the ability necessary to solve the more difficult problems confronting him in his new position. It was decided to transfer him again to street work, and this was tactfully accomplished by the department head. Result: Peterson has completed two more successful years in collection work.

Miss Hart was employed upon graduation from high school as a typist and clerk for the summer period when regular employees were on vacation. Her test scores revealed a girl of very high ability who appeared to be an excellent typist. The ratings that came through after three months showed, however, that she was not doing her job satisfactorily. She was reported as "having no initiative"; "confused under pressure of work"; and "lacking in ability."

An investigation by the personnel director disclosed that this employee had been taking work from three different men, and this circumstance combined with the pressure of a busy summer had apparently been con-

fusing for a young girl of no previous experience. Conferences between Miss Hart and the personnel director and the psychologist revealed, as might be expected, that she was in a confused mental state as a result of the complicated situation described. Also it was learned that certain business practices she had been taught at high school were dissimilar to those observed by the company, and this further increased her confusion. It was decided to give her a trial in another department where she would be under the guidance of a tactful woman supervisor and have simple duties to perform. In the course of a few weeks she began to brighten up and has proved most satisfactory on all counts since. Indeed, she is now an employee of unusual promise because of her high mental ability.

These illustrations indicate how information obtained by means of ratings can aid in analysis of problems which would be difficult of solution if this information were not available.

CONSTRUCTING A RATING FORM

After the existence of a problem is recognized and there is agreement that its solution can be assisted by ratings, the preparation of the details of the plan may be left to the personnel director and a small committee representing operating departments.

Most personnel men believe that the way to "sell" an organization on a sound rating plan is to induce its members to participate in its formulation. However, this is true only to the limited extent of securing a committee to collaborate with the personnel director; it is not true if the committee itself is expected to devise the plan. This is because satisfactory rating plans are not devised casually or by uninformed persons. Much sounder results will be attained if the personnel director—assuming he is a man of ability—works out details and submits them to the judgment of an advisory committee. When a form is agreed upon, this may then be put into use in the organization. All the benefits of participation by executives can be obtained by means of an advisory committee. But even a small committee cannot take time to become sufficiently informed on technical details to evolve a satisfactory rating plan. It can be entrusted, however, with the approval of the plan recommended by the personnel director —indeed, any plan, to be satisfactory, must meet the test of practical use in the hands of busy operating executives.

THE ADVISORY COMMITTEE

An effective spearhead for a rating plan may be an advisory committee composed of senior executives, working in cooperation with the personnel director. By placing responsibility for the plan in the hands of such a

body, attention is diverted from the personnel officer, and he can formulate the necessary details under the aegis of the committee. Since the committee comprises senior officials, it will possess prestige that a personnel director often may lack, and other executives will be less likely to question a rating plan for this reason.

An important advantage of such a committee is that it represents the viewpoints of different departments, and its members provide a wide range of experience which will insure that any plan adopted will be satisfactory. Such a committee may prove of great assistance to the personnel director in avoiding mistakes in the preparation of details as well as in installation of the program.

The members of this *supervising* committee will come to acquire pride in the success of the plan and will not take kindly to unnecessary interference or to criticism of it by other executives of the organization.

Leadership, as always, must be provided by the personnel director, and he must take the initiative in guiding the thoughts of the committee. The experience of one company indicates that it is sometimes wise to place on the committee the most critical member of the executive staff. If support of the company president is assured, this fact will impel the critical member to assume his responsibilities on the committee, and in time he will come to appreciate the importance and value of the rating plan for which the committee is responsible. The personnel director will be better off with a committee composed of strong men than with a rubber-stamp committee of individuals with little ability and less prestige.

To keep the committee active, it is advisable to supply it with suitable reading material and with opportunities for attendance at conferences where the rating problem will be discussed. Thus, as the committee members become better informed, they will take increasing interest in the problem and will defend the rating plan at every turn. Subsequently, constructive ideas will be forthcoming from the members of the committee, some of which may have been inspired earlier by the personnel director. In any case, the plan will gain momentum through the increased understanding of the committee members.

LAUNCHING THE PLAN

Even more important to success than the technical details of any particular type of rating is the careful launching of the plan.

After a strong committee has been appointed and its members' education has proceeded, the time will come for formal introduction of the plan to the rest of the organization. Even with the support of a strong committee, a rating plan should not be launched in wholesale fashion but

should be applied to the solution of specific problems, as has been illustrated. It is not only undesirable but unnecessary to "spring" a new and radical idea such as employee rating on an unsuspecting organization. Furthermore, by commencing with the newer employees it will be necessary to handle only a small volume of reports at the outset.

Not only should no attempt be made to inaugurate a rating plan fullblown; above all, it should not be introduced through the medium of a formal report. Such a report is a target for organization criticism. The manner of introducing employee ratings should be more subtle and less direct—i.e., the existence of specific problems should be established; when this has been done, ratings may be suggested as an aid to their solution.

WHOM TO RATE

Mention has been made of the advisability of avoiding formal reports in launching a new rating plan. Another thing to avoid in the first stage is the rating of supervisors. Instead, this is the last step to be taken in putting a rating plan into successful operation. If supervisors, even junior ones, are rated at the outset, opposition may be generated which will be fatal to the plan.

It may be advisable to avoid rating older employees at first for the same reason. One organization has achieved best results by rating at the outset only employees of less than three years' service. It was then possible to extend rating gradually to the older employees without arousing the opposition that would have resulted if longer-service employees had been included in the first place. (Proposals that initially involve rating old employees sometimes arouse the antagonism of executives.)

USE OF TERMS

Avoid the use of technical terms in discussing or writing about ratings. One organization refers to them as "Employee Reports" and never uses the word "rating." Shun such terms as "technique" or "criterion."

EXTENDING THE PLAN

Take advantage of every opportunity to put in a favorable word for employee rating reports. For example, when an employee of long service is criticized and his case is discussed, it may develop that there are no records dealing with his performance in earlier years. This provides an opening to point out the value of formal written reports as a means of establishing a permanent record. When it is necessary to dismiss an employee, records of this kind prove invaluable.

Indications have been given of types of problems that can be solved with the aid of ratings. Frequently ratings may be employed only in specific cases of this kind, thus accustoming the organization by degrees to their use. This can be done without any formal recognition of the idea of rating as such.

When the policy of employee reports has been established for persons of short service, it is usually a simple transition to the use of reports on all those of longer service whose work has been criticized. Finally, application of a successful plan of this kind to all employees follows naturally.

KEEP THE PLAN "SOLD"

The personnel director and the advisory committee will find it necessary to "sell" the rating plan constantly. Every incident that arises may be cited as an example of the need and value of ratings. For instance, an analysis in one organization disclosed 23 unfavorable ratings in a period of six months. The personnel director reported to the President's Advisory Committee on Operations that, of these 23 ratings, 13 were dealt with by dismissal, nine of the cases being temporary employees and four permanent. In two cases employees had been transferred and satisfactorily adjusted to other jobs, and in three cases demotion had proved an effective solution. This left only five unadjusted cases which were under consideration at the time. No better argument could be advanced for the value of formal ratings than that they necessitate the recognition of a problem and assist in its prompt solution.

The personnel director must not only engage systematically in a selling campaign to acquaint the organization with the value of employee reports; he must in addition bring before the advisory committee facts which will keep it adequately informed and interested in the success of the plan.

INDUSTRIAL RELATIONS AND NATIONAL DEFENSE: A CHALLENGE TO MANAGEMENT

By DOUGLAS McGREGOR and IRVING KNICKERBOCKER
Industrial Relations Section
Massachusetts Institute of Technology

Now that "all-out effort" is our watchword, major changes in organization and procedures have become the order of the day. How can such technical changes be introduced without antagonizing workers and disrupting the efficiency of the defense program? The solution of this problem involves extensive research into the informal group relationships existing in the factory, declare the authors of this study; it requires intimate understanding of the attitudes and perspectives of the individuals affected. In this process a new kind of personnel administration may be called for.

AS "National Defense" becomes a byword, the crucial importance of super-efficient industrial production is more apparent to all of us. Concomitantly, the problems of industrial relations loom larger and larger on the horizon. Shall the right to strike be abrogated? Shall the arbitration of labor disputes be compulsory? Is organized labor selfish and unpatriotic in demanding a larger share of industrial profits? Or, as some labor leaders assert, is management seizing a golden opportunity to cry "Wolf!"? These questions, and many similar ones, are discussed hotly today in all the places where men gather. We recognize that the potentialities of our technical machinery will not be realized so long as there are serious sources of friction between those who manage and those who operate our factories. Must we wait until actual disaster is upon us before we make serious attempts to reduce this friction?

A thoughtful consideration of the current national situation suggests that strikes and industrial disputes are but symptoms of underlying unrest, and that one rarely cures a malady by treating the symptoms. Starting up a fan to blow the smoke out of the rooms on the second floor won't put out the fire in the basement. Setting up successful methods for dealing with strikes is necessary and praiseworthy, but we must somehow get at, understand and correct those underlying factors which tend to create friction between management and labor. Only to the extent that we do so can we tap the great capacity of the American people for "all out" cooperative effort.

If past experience and current indications are reliable guides, there will be a vast difference between the methods used in solving our technical problems of production and those used in dealing with the problems of

industrial relations. The problems of production will be solved not by haphazard trial and error, but by careful, critical research. The problems of industrial relations will be "solved" by decisions reached in the heat of emotional argument, and on the basis of "evidence" made up primarily of conflicting opinions and unverified beliefs. Is there not a better way?

The scientific study of human relations in industry, while still in its infancy, has already demonstrated its fruitfulness. Moreover, the principles which have been discovered are not new to the social scientist. They are principles which have been established over and over again in the study of a variety of social groups, from primitive tribes to modern political parties. It is the thesis of this article that the first step toward a solution of some of the crucial problems of industrial relations lies in a general understanding of these principles and of their implications. There is no doubt that our knowledge is still tragically limited, but, well-known epigrams to the contrary, a little knowledge cautiously applied is a useful, not a dangerous, thing. Let us therefore examine the knowledge we now have in the light of its possible application to the present situation.

The man who lives in our civilization belongs to a large number of reasonably stable social groups. He is a citizen of a nation, of a state or province, and often of a city. He may be a member of a church or a fraternal group. He is a member of a family, and of a neighborhood. He obtains certain satisfactions from his membership in each of these groups. If he did not, he would cease to "belong" to them.

SOCIAL GROUPS IN INDUSTRY

We sometimes fail to recognize that there are a number of important social groups connected with a man's job. He belongs to a group made up of the employees, supervisors, management and stockholders of the company for which he works. If the company is large, the local plant comprises another social group to which he belongs. In addition, he is a member of a departmental group. Finally, he belongs to a small group of workers with whom he is in fairly constant face-to-face contact.

Despite the fact that it is traditional to think of "work" in terms of unpleasant duties, we all obtain a tremendous amount of satisfaction from "the job." Members of the management group recognize the satisfactions which they obtain from their work, and from the social relationships which are part of it, but they seldom realize that the same thing is true of the worker. He does not cease to live when he arrives at the factory. If he did, the "revolution" would long ago have been an accomplished fact, and the factory system would be part of a forgotten era. The most important of the satisfactions obtained from the job are those which come from asso-

ciating with one's fellows. The social groups connected with a man's job are, in their sphere, as important to him as his family.

A collection of individuals becomes a social group by virtue of the fact that its members develop habits of action and thought which become the accepted practices, the customs, and the public opinion of the group. In his personal behavior, every individual develops thousands of habitual ways of acting and thinking which are uniquely his own. We constantly use our knowledge of these habits in attempting to deal with our associates: "The boss went through the office this morning without stopping to talk to the reception clerk. Better hold off until tomorrow on that proposal for a new laboratory bench." Or: "Don't come back at him with an immediate judgment of any idea he proposes, however crazy it sounds. Say you'd like to think it over. If you return with a criticism tomorrow, he'll probably accept it; if you offer the same criticism today, he'll decide it's a snap judgment and ignore it."

SIGNIFICANCE OF CUSTOMS

In the same way social groups develop common habits of action and thought. When these are common to large, scattered groups, we refer to them as customs and recognize their tremendous importance. The wearing of clothes, the taking of but one wife, the respecting of the property rights of others—these and many other common habits of our western civilization are recognized and respected by those who wish to deal peaceably with us.

When, however, the groups are small, and when there are no political designations which serve to set them apart from other groups, we sometimes tend to forget that they may possess customs which are as important to them as the right to vote may be to a member of the group which we call the United States of America. In the factory, within each face-to-face social group that exists for any length of time, customs (habits of action and thought) develop which have vast importance for the members of the group. The existence of a common vocabulary of terms referring to the experiences of the group, the common possession of a unique skill, or of physical prowess, the belief that the work is dangerous, or especially vital to the success of the whole organization—these and a thousand other customs are knit into the warp and woof of social groups in the factory.

Not only are these customs important as behavior, but they acquire a value for the members of the group which may be out of all proportion to their practical utility. The prestige attached to wearing a white shirt instead of overalls is far more important than any considerations of cleanliness and neatness would suggest. And the grimy faces of the boiler-room gang may be badges of membership in a group that "knows how to take it."

The more the development of our industrial civilization tends to make all workers alike, the more do face-to-face groups strive in ways such as these to set themselves apart as unique and different.

In addition to these things, there develop habits of relationship between individuals which also have the force of customs. The intricacy of such relationships within any group is almost unbelievable until one has examined them in detail. Let the reader ignore for a moment the organization chart of his company and consider instead the nature of the actual relationship which exist between himself and his superiors, his associates, and his subordinates. Who gives orders or advice to whom? Who accepts orders or advice from whom? Who must be handled "with kid gloves" because he is jealous of his authority? These are habits of relationship within the group which are known and adjusted to constantly by anyone who "knows the ropes." If they are not adjusted to—if one does not "know the ropes"—the whole group may be disrupted, and its normal smooth efficiency reduced almost to zero. Roethlisberger and Dickson, in their study of the now famous Bank Wiring Room at Hawthorne,[1] have amply demonstrated that these systems of relations exist also in the factory group, and that interference with them is markedly disruptive of efficiency.

RESISTANCE TO CHANGE

This characteristic of people as individuals, and as members of social groups, to develop many habits would be merely an interesting but unimportant phenomenon if it were not for one thing: Habits (both of behavior and thought) possess inertia; they are resistant to change. Unfortunately, perhaps, a great many circumstances make changes in our habits imperative. And in this fact lies the basis for frequent disturbance of social harmony.

Resistance to change is, of course, relative. Some men resist changes in their habits more than others. And, for all of us, some habits are more readily changed than others. There are a number of generalizations about this resistance to change which are at least roughly true:

(1) Habits that are closely related to the satisfaction of our important needs are particularly difficult to change. Marriage or divorce, for example, involves notedly difficult changes in the habits of the individuals concerned. When one considers that the average adult worker spends at least as much of his waking life on the job as with his wife, and when one remembers the basic needs that are associated with making a living, it will be recognized that many of the habits connected with the job and the working group do not change easily once they are established.

[1] Roethlisberger, F. J., and Dickson, W. J. *Management and the Worker*, Harvard University Press, Cambridge, Mass., 1939, Part IV.

(2) Habits do not change until the necessity for change becomes clearly apparent to the individual. Because of the inertia of habits, the necessity for change is often unrecognized even though it is present. In fact, we frequently appear to fight against recognizing the necessity for changes that is apparent to everyone but ourselves. This is a most significant point, because industrial management frequently attempts to bring about changes in the habits of employees when the necessity for change is not at all apparent to them. Resistance in some form or another under such circumstances is almost inevitable.

(3) By and large, people tend to resist the efforts of other people to change their habits. This point ties in closely with (2) above. It is possible to bring others to a realization of the necessity for changes in their habits, and then changes do generally occur. This is the function of most propaganda and advertising. But the successful propagandist or advertiser knows that it may require remarkably subtle and ingenious tactics to bring people to the point where they *want to* change their habits, or where they believe it is *necessary* to do so. In spite of a good deal of lip service to the notion of "educating" employees to accept this or that change, industrial management has not, on the whole, been too successful in this direction. Perhaps management itself needs to be "educated" by its own advertising staff!

MANAGEMENT'S DEFECTION

Most of these generalizations are obvious. It is remarkable, nevertheless, how regularly they are ignored. They are rarely taken into account when a department is "reorganized" and an established group of workers is broken up and scattered among other departments. And when management decides to introduce a change in a specific production process, or to alter the length of a rest period, or to install new safety devices on all the machines in a given department, these generalizations are frequently completely ignored. Accusations of "speed-up," restriction of output, even open resistance and strife, are not, under such conditions, merely the result of the agitation of radicals; they are the predictable consequences of management's failure to recognize that changes in technical processes almost invariably involve changes in the social habits of employees.

It must be emphasized at this point that there is no intention here to deny management's *right* to change methods of production or the organization of the working force. It is inevitable that such changes will occur in the interests of greater efficiency. And, as the defense program gets into high gear, such changes will be far more frequent than they have been in the past. *It is not the fact of change, but the method of bringing it about,*

which is important if we are going to achieve a greater degree of cooperation between management and labor.

Another aspect of this problem must be considered before proceeding to a consideration of "what can be done about it." It may be argued that industrial management *has* considered the effects of technical changes upon the employees. This is true to a limited extent. But in a great majority of cases the action that has been taken has been based on false assumptions about "human nature." The proof of this statement lies in management's notable lack of success in bringing about the desired changes without friction. Two of these false assumptions are of sufficient importance to warrant consideration here.

WORKER MOTIVATION

The first is the assumption that workers are motivated exclusively (or even primarily) by financial considerations. Not only is modern psychological theory at odds with this assumption, but the empirical evidence contrary to it is considerable. The work of Houser,[2] Hersey,[3] the investigators of the British Industrial Health Research Board,[4] and more recently of Bakke[5] may be cited merely as examples. Generalizations asserting that one motive is stronger than another must take into account the relative scarcity of those things which satisfy the needs involved. As wages become relatively more adequate, other things become relatively more important. The starving man may literally refuse food in order to satisfy his need for self-respect, but only if things which will satisfy his self-respect are scarcer than food. Factory workers would strive less desperately to express their uniqueness and importance if this expression were not denied them by the increasing regimentation of industrial life. The demand for air is not ordinarily a strong motive, but to a group of men facing suffocation in a wrecked submarine it may become the most powerful of all drives.

Despite these fairly obvious considerations, it is remarkable to note the tenacity with which industrial management clings to the belief that the only thing which need be considered in introducing a given change is the effect on the worker's pay envelope. Even the fact that in many firms there are more grievances concerned with wage *differentials* than with basic wage *rates* seems to have escaped notice. And the prevalence of "restriction of output" under incentive systems of wage payment suggests that things other

---

[2] Houser, J. D. *What People Want from Business,* McGraw-Hill Book Company, Inc., New York, 1938.

[3] Hersey, R. B. "Employees Rate Plant Policies," *Personnel Journal,* September, 1937, pp. 71-80.

[4] For example, Wyatt, S., Frost, L., and Stock, F. G. L. *Incentives in Repetitive Work,* Industrial Health Research Board, Report No. 69, London, 1934; H. M. Stationery Office.

[5] Bakke, E. W. *The Unemployed Worker,* Yale University Press, New Haven, Conn., 1940, chapters I-IV.

than the amount of the wages received are frequently of considerable importance to the worker.

The fact that wages appear so frequently as the major demand in union-management negotiations is not a contra-indication. Wages are tangible. Demands in terms of them are easily stated and clearly understood. When other resentments and sources of dissatisfaction are but vaguely realized because of their lack of concreteness, it is easy for workers to focus their dissatisfaction upon their wages. Shrewd union leaders are well aware of this fact, and they make the most of it.

A MATTER OF PERSPECTIVE

We make the second false assumption when we interpret the behavior of other people in terms of ourselves: When people do not behave in a manner which *we* ourselves consider to be logical, we tend to think that their behavior is illogical. In terms of *our* logic, their behavior is senseless. Moreover, we frequently assume that they are either stupid or wilfully malicious.

The behavior of an individual is invariably logical in his own eyes. Whether it is logical in the eyes of other people depends upon whether they and he have the same "perspective" of the situation within which the behavior occurs. The management of a certain firm installed blue-green lighting in a department where the work involved considerable eyestrain. Experimental tests had shown that the eyestrain was materially reduced by this type of lighting. The men in the department reacted logically to the change (from the point of view of management): Their output increased, and they complained less than formerly of fatigue. The *women,* on the contrary, reacted quite illogically (again, from management's point of view): Their output fell off, absences increased, and complaints and dissatisfaction noticeably increased.

It was not until management discovered that the women felt that the new lighting made them look "simply ghastly" that the peculiar reaction was understood. The "perspective" in terms of which the women viewed this situation included their desire to look as attractive as possible. Management, not having considered this aspect of the matter, perceived only the "illogicality" of the behavior.

Whether or not the behavior of others appears logical to us, then, depends upon our understanding of *their* perspectives—their points of view. We must not assume that, because their behavior does not make sense in terms of *our* logic, it is stupid or malicious. Everyone does not regard a given set of circumstances in the same light. Perspectives—including wishes,

attitudes, beliefs and opinions—differ from group to group, and even from individual to individual.

It does not require a great deal of thought to perceive the importance of this point for the problem at hand. The lives, the very "worlds," of the worker and of management are tremendously different. Moreover, it has already been pointed out that all social groups (even the smallest face-to-face groups in the factory) develop unique habits of action and belief. It becomes apparent, therefore, that before we can hope to bring about a desired technical change in the factory without creating friction and unrest we must know the underlying desires, opinions, and habits of thought in terms of which the group affected will view the change. Otherwise the method which will be used to bring about the change may seem logical to us but illogical—perhaps even malicious—to them. And if the effect of the change is lowered efficiency, it may appear incomprehensible to us but perfectly logical to the group whose habits have been disrupted. Once more it must be emphasized that it is not the *fact* of change which is important, but the preparation for it and the means utilized in bringing it about.

COERCION VS. PERSUASION

A decision as to whether a group of workers is behaving maliciously in restricting output, or in calling a strike, depends upon accurate knowledge of *their* perspective of the situation. Such undesirable behavior can be changed more readily by making the change seem necessary to *them* (i.e., by altering their perspectives) than by coercion. To be sure, this task of changing perspectives is not always an easy one. It is not, however, a futile one. Attempting to change the behavior by coercion is treating the symptoms, not the malady. And this *is* futile. We may prevent strikes by legislation (for example, by punishing strikers in defense industries with the electric chair, as has been recently suggested by a member of the House of Representatives).[6] Whether this will increase the efficiency of our industrial production is a question which few thoughtful people would answer in the affirmative.

The demands imposed on management by the defense program are primarily for increased production. A great many changes inevitably result. Plants are expanded, departments reorganized, processes of manufacture changed, procedures "streamlined," new rules instituted. And the tempo of these changes is at present accelerating steadily. Unless great care is taken to determine that the disruptive effect of these changes upon employee groups is minimized, the all-important morale of the working force

[6] Raymond Moley and Celeste Jedel, "The Gentleman Who Does Not Yield," *The Saturday Evening Post*, May 10, 1941, p. 104.

is bound to be reduced. Even if there are no overt symptoms of resistance and revolt, there will be less enthusiastic effort, less cooperativeness, less efficiency. A kind of unconscious sabotage—not deliberate, but vitally serious because it cannot be *directly* perceived or dealt with—is almost inevitable.

We want to develop the morale of the working force, we want to encourage enthusiastic cooperative effort, we want to increase efficiency to the utmost. *These things we can accomplish only if the changes which are made in technical processes are perceived as necessary and reasonable by those whom the changes affect.* Coercive tactics applied *after* resentment of changes has flared up in the form of strikes and unreasonable demands will not help. Such tactics may reduce the objective symptoms of unrest, but this means only that the manifestations will be driven "underground" where they cannot be directly dealt with. And, as a result, they will operate with a far more deadly effect.

MANAGEMENT "PREROGATIVES"

The discussion up to this point has been concerned almost exclusively with matters relating to management's treatment of its employees. We are now going to ask the reader to shift his frame of reference. If he is a member of the management group, let him reconsider this discussion, keeping his own group rather than labor at the focus of attention. Let him ponder first how many of *management's* habits of action and thought have been changed by legislative action and judicial edict during the past decade. Let him realize how frequently not only habits common to management in general, but those peculiar to his own organization, have been disrupted by governmental interference with the "prerogatives" (i.e., beliefs, attitudes, opinions) of his group. And let him consider the antagonisms and resistances which were the results—the symptoms—of this disruption.

If he or his firm has faced for the first time during the past few years the necessity for dealing with organized labor, he will have still more evidence in the light of which to weigh the merits of the foregoing analysis. For organized labor and government alike have ignored these principles in attempting to change the habits of action and thought of industrial management. They, too, have dealt coercively with the *symptoms,* and not with the causes, of poor industrial relations.

This article is addressed primarily to management, but not with the implication that management alone is to blame for our ills. To be sure, unhealthy practices of some managements in the past, and of a few even today, have provided soil in which the seeds of industrial unrest have flourished. But it is our purpose to challenge, not to condemn.

There is a positive point here of great importance: Industrial management in this country today possesses some of the most amazing ability the world has ever known. Its talent for showing the world how to solve problems, how to achieve the impossible, is unexcelled. If we are to free the energies of the men of industry—management and workers alike—for the gigantic tasks of defense, these talents of management must be brought to bear upon the problems of human relations in industry. Industrial management—if it will—can show us the way. If, through the bitterness of its own experience during the past decade, management can come to a full realization of the nature of the underlying flaws in our system of industrial relations (i.e., if management perceives the necessity for changing *its own* habits of thinking about, and dealing with, its employees), our problems will already be half solved! This group has led the way to a better *material* world in which to live; let it now show us how to remove the obstacles which block the road to a better *social* order. And let it start with human relations in the factory—the place where management has already demonstrated its great genius.

APPLICATION OF PRINCIPLES

We come now to the question of the use to which these principles may be put. It is not our intention to suggest that knowledge of them will solve all industrial relations problems. We are not offering a panacea. But knowledge of these principles is an absolutely essential *first step* toward ultimate solutions. The second step is to make practical use of them in dealing with the necessity for technical changes in industry.

Some of the subsequent statements will appear obvious. While they *are* obvious, they are too frequently ignored. It is one thing to give lip service to principles; it is another thing altogether to apply them in practice. For this reason we feel no hesitation in stating them even though, in other contexts, they have been stated before.

First of all, *in planning any change in technical processes it is necessary to think in terms of the human beings who will be affected by the change.* Even minor changes in procedures and processes may have major consequences for industrial relations. The decision to substitute a conveyor belt for hand trucks in transporting finished material from production departments to the shipping room may upset a whole series of intricate social relationships.[7]

In one plant, the practice of having technical experts request oral permission from a member of the management group before attending sci-

[7] Truckers, because they are in constant touch with several social groups, may serve an important integrative function.

entific meetings at company expense was changed by a rule requiring a *written* authorization. This change was viewed by management as necessary (because the old practice had been abused) and entirely reasonable. Nevertheless, because insufficient care was taken in planning the method by which the new rule was introduced, repercussions within the group affected were apparent several months afterwards. In this case the men were not ordinary workers but design engineers. The individuals who will be affected by a proposed change cannot be ignored even when they are part of the management group itself.

Second, in considering the individuals who will be affected by a change in process or procedure, *it is necessary to be familiar with their perspectives* —with their wishes, attitudes, and habits of action and thought. It is not enough to consider them as human beings, or even as workers, or union members. An intimate knowledge of the *unique* perspectives of the particular individuals or groups involved is essential.

SOURCES OF KNOWLEDGE

There are a number of ways of acquiring this knowledge. *If management has taken sufficient care in hiring and training its supervisory force,* the foreman may be the best source of information. On the other hand, if the foremen are not adequately trained in the observation and interpretation of human behavior, it may literally be dangerous to rely on information obtained from them.

If the plant is unionized, and if relations with the union are reasonably amicable, the shop stewards can be very helpful. The regular grievance machinery, handled sympathetically by management, can furnish a great deal of pertinent information about the perspectives of social groups in the factory.

A skilled consultant who has specialized in the field of industrial relations and who is aware of the importance of the principles discussed above can be of considerable assistance. He has two distinct advantages: (1) He is an "outsider," and for that reason he will be told things that a member of the organization might never hear; and (2) he has a knowledge of the techniques and methods which are most useful in obtaining accurate knowledge of the "customs" of social groups.

USE OF "COUNSELORS"

The Hawthorne Plant of the Western Electric Company, as a result of lengthy researches, makes use of a group of "counselors" who are attached to many departments but who are outside the line organization. Each employee in these departments is given an opportunity from time to time

to consult with the counselor and to discuss anonymously anything he may have "on his mind."[8] Quite aside from the benefit to the employee in having the opportunity to talk things out, the information acquired by these skilled interviewers can be utilized in obtaining an understanding of the perspectives of the various social groups.

One need hardly stress here the fact that the use of these counselors as a means of espionage would completely defeat the aims of this plan. The information obtained should be kept anonymous; no individual should ever be punished for anything which may be revealed to the counselor. But, just as the information may be used in settling grievances and adjusting complaints, so it may be used in deciding on the least disruptive method for introducing a contemplated change.

Despite the frequently heard contention of industrial managers that they "know their workers"—regardless of whether the "boss" can call his workers by their first names—it is only *very* rarely true that management is really aware of the perspectives of the employees. The fact that management is so often surprised by the reactions of its employees lends weight to this assertion. Actually, most executives are only partially aware of the perspectives of their own immediate subordinates. In general, unless the industrial relations of the plant have been remarkably good for some time, it is unwise to depend upon people within the organization for knowledge of this kind. If people are hired to obtain the information, they should be kept entirely outside the line organization. Otherwise, regardless of their skill, they are likely to be unsuccessful because of the fear generated by their authority.

SELECTING THE RIGHT APPROACH

There still remains the problem of the method to be used in introducing the change which is contemplated. Given a genuine realization of the importance of the human factor in determining the success of technical changes, and given a real knowledge of the perspectives of the human beings who will be involved, this problem will be readily solved in many instances. Sometimes it may be apparent that the cost in terms of the loss in human efficiency will be too great to warrant the change.[9] This is no cause for sorrow. Many *possible* technical changes are rejected because the purely engineering costs of installation are too great. Other means for achieving the desired end are sought.

In many other instances, knowledge of the perspectives of the people

[8] Wright, H. A. "Personal Adjustment in Industry," *Occupations*, April, 1940, pp. 500-505.
[9] Consider the case involving the blue-green lighting system cited previously.

who will be affected will immediately suggest the "right" method for introducing the contemplated change. What is required in these cases is no more than common sense. The right approach would not be perceived without adequate knowledge; with this knowledge it is obvious.

In some cases the possession of the requisite knowledge will still suggest nothing about the proper way to proceed. These are the times when ingenuity, insight, intelligence, and a thorough knowledge of human psychology are of paramount importance. Even with these, a certain amount of cautious trial and error may be required. If the change is really necessary, and if those who will be affected are not already antagonistic and suspicious because of management's past treatment of them, they can usually be brought to perceive the necessity for the change. And this is, of course, the basic problem. If the employees are antagonistic and suspicious of management, many of these more difficult changes may have to be postponed until they become aware that management is not either deliberately or blindly interfering with established habits. Under such circumstances simple changes that are practically certain to be well received would have to precede difficult ones.

If these suggestions seem to the reader to be vague and of questionable value, let him consider the procedure of the engineer in tackling a tricky technical problem. He begins with a knowledge of the relevant principles. Then he marshals facts. He learns everything he can about the problem. But from then on he does not simply apply formulae automatically. A solution will depend upon his ingenuity, his imagination, the breadth of his past experience. He may try out a "hunch" tentatively. If it works, all is well; if it doesn't work, he has learned something from the trial, and he seeks another possible method. It is nonsense to assume that the mere possession of "the facts" is all that is required for the solution of difficult problems in any field. And if ingenuity, insight and imagination are required in dealing with machines or chemicals, we would be fools to deny their importance in dealing with intricate problems of human relations.

UNION COOPERATION

The presence or absence of a union in the plant will not affect the utility of the methods presented in this article. Under optimum conditions, however, the presence of a union may simplify relations with workers by providing an avenue of approach through union leaders, men whose responsibility it is to know and interpret the attitudes and desires of the diverse groups of workers. As a matter of fact, when mere collective bargaining ripens into union-management cooperation, it is because these prin-

ciples have been successfully utilized (consciously or unconsciously) by both management and union leaders.[10]

Where human relations are involved, there is perhaps no more fundamental generalization than this: "It isn't *what* you do that matters, but *how* you do it." That is why few, if any, specific rules can be offered in connection with these problems. Each proposed change must be handled in the light of knowledge of the immediate circumstances and of the particular group affected. An underlying recognition of this fact will itself alter the way in which management perceives the problems involved in a given change. With this altered perception, the necessary steps will more often than not be obvious.

SUPERVISORY OPPOSITION

There are some almost inevitable difficulties in dealing with the problems of industrial relations along the lines suggested here. In the first place, nearly everyone feels that he "knows human nature." We are all expert psychologists by our own reckoning. Usually, only the psychologist himself (and not always even he) is willing to admit that his ability to understand and deal with his fellows is limited. Management will inevitably find those in its organization who are so sure of their ability to understand and deal with people that they will constitute an initial barrier. But similar situations have existed in other fields. Some "practical" men have always resisted the adoption of "newfangled" methods for dealing with old-fashioned problems. Fortunately, most of them can be shown. Being "practical," they find demonstrations convincing even where arguments fail.

It is often pointed out that the first-line supervisors are the key to good industrial relations. If the arguments presented in the first sections of this article are correct, the foreman is indeed crucial to management's success in handling human problems. He above all others is in a position to be aware of the habits of action and thought of those whom he supervises. If he is trained to keep his eyes open, and to make effective use of the knowledge he obtains, he can be invaluable in dealing with industrial unrest at its source. But it is right in this group that these ideas are likely to meet with the greatest resistance. Western Electric has done some interesting and valuable work in attempting to give its foremen a better understanding of the social psychology of industrial relations.[11]

Another difficulty will perhaps already have occurred to the reader. At the moment, in facing the crucial situation abroad, speed is vital. These

---

[10] Ruttenberg, Harold J. "The Fruits of Industrial Peace," *Harvard Business Review*, Spring, 1940, pp. 285-294.

[11] Roethlisberger, F. J., and Dickson, W. J., *op. cit.*, Chapter X.

ideas may be fine for a long-range program; are they not useless when speed is of the essence? The answer depends upon one's perspective! Management would not think of introducing a major change in the technical design of an aeroplane without a good deal of careful research *almost regardless of the time and effort involved.* If the change were made without adequate knowledge, the costs might be measured not alone in terms of efficiency but even in terms of human lives.

The analogy should be clear. If important changes in organization, in process or procedure, are made without adequate foreknowledge, the results in terms of frictions in human relations may lower rather than increase efficiency. And lowered efficiency in industrial production today may literally mean disaster. We can avoid these consequences only if proposed changes are carefully considered in the light of their probable effect upon human relations in the plant. A new kind of personnel administration may be required. A certain amount of research upon the habits of thought and action of employee groups may be necessary. Management may have to make more extensive use of the counsel of union leaders in its own plant, or of its industrial relations executives, or even of outside consultants. But, above all, let us cease to give mere lip service to the principles of human relations. If the successful solution of these problems requires research, let us get at it. If it costs money, what of it? "All out" effort is our goal.

Books for Personnel Executives

THE SELECTION AND DEVELOPMENT OF PROSPECTIVE FOREMEN. By John W. Riegel. University of Michigan Press, Ann Arbor, Mich., 1941. 69 pages. $2.00. A critical discussion of the elements in existing and projected programs for the selection and development of potential foremen. Topics include: responsibilities of foremen and sub-foremen; selection of candidates for training; helping candidates to understand supervisory problems; developing candidates' managerial skills and personality traits. This study is based on a rapid survey of executives of 20 leading companies.

THE FIELDS OF PERSONNEL WORK. By John G. Darley and Ralph F. Berdie. Science Research Associates, Chicago, 1941. 48 pages. 50 cents. This monograph presents a brief general introduction to the fields of personnel work for those considering a career in this profession. It attempts to outline the types of work, discusses generally the training requirements, earnings, promotion routes, and the nature of the various jobs.

SUGGESTED PLANS OF JOB EVALUATION. Report No. 3, Clerical Salary Study Committee. Life Office Management Association, New York, 1940. 54 pages. $2.00. Two plans of job evaluation are offered in this report: the L.O.M.A. Point Evaluation Plan, which measures the "content" of a job in terms of each of 11 carefully defined characteristics; the Job Element Evaluation Plan, which appraises the job content in terms of the operations performed. While these plans have been developed for home office positions of life insurance companies, they are adaptable to clerical positions in industrial fields.

LABOR CASES AND MATERIALS. Edited by Carl Raushenbush and Emanuel Stein. F. S. Crofts & Co., New York, 1941. 674 pages. $4.00. These readings on the relation of government to labor are divided into two parts: the first, by Raushenbush, deals with the influence of government on the relative bargaining power of labor unions and employers, and thus on conditions of labor; the second, by Stein, deals with changes in conditions of labor brought about by government in dictating certain minimum terms for the labor contract.

TRAINING WORKERS AND SUPERVISORS. By Charles Reitell. The Ronald Press Company, New York, 1941. 182 pages. $1.50. This latest book of Dr. Reitell furnishes a key to the newest and best procedures for rapidly expanding the plant organization. Written in entertaining, readily understood shop parlance, it presents fundamental guiding principles that can be readily applied in setting up training programs.

PUT YOURSELF TO THE TEST. By Edward C. Webster. Harper & Brothers, New York, 1941. 129 pages. $2.00. This "manual of vocational self-guidance" is addressed to the maladjusted jobholder and to the job seeker who wants to know what he is best fitted to do. The reader is shown how to select a competent vocational counselor; methods are outlined for considering vocational choices, for acquiring the necessary training, etc. For those who must dispense with a counselor, the book offers a series of ability, aptitude and interest tests.

OCCUPATIONS IN RETAIL STORES. By Dorothea de Schweinitz. International Textbook Company, Scranton, Pa., 1941. Second edition. 422 pages. $2.75. Part I of this study deals with the general matter of retailing and working conditions common to all retail employees; in Part II here are classified and fully described 45 occupations which constitute the major employment opportunities in retail stores. This revised edition makes more extensive use of the 1935 retail census, and includes more information on the cooperative movement and on the recent growth of labor organizations in the retail field.

PUBLIC SPEAKING TODAY. By William G. Hoffman. Whittlesey House, New York, 1940. 355 pages. $2.75. An exceptionally practical guide to the technique of public speaking and the preparation of every type of speech, including radio and round-table. Among the important features are chapters on voice and on how to conduct a meeting.

METHODS FOR SELECTING SALESMEN. *Dartnell Report No. 508.* The Dartnell Corporation, Chicago, 1941. Section I, 32 pp. plus forms; Section II, 21 pp. plus forms. General methods of selecting salesmen are covered in the first part of this survey, while the second part is devoted to experience with aptitude testing for sales applicants. Reproductions of application forms, interview checking blanks, rating forms, and other material used in connection with hiring salesmen constitute a valuable feature of the report.